Y/NS-0001/R1

Preliminary Reassessment of Known Vulnerabilities at the Y-12 Plant

November 1997

Prepared by the
Y-12 Plant
Oak Ridge, TN 37831-8235
operated by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
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U.S. DEPARTMENT OF ENERGY
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Executive Summary

As a result of the explosion at the Hanford Plutonium Reclamation Facility on May 14, 1997, Secretary Federico Peña directed the Department of Energy (DOE) Operations Office Managers in an August 4, 1997, letter to implement several broad-based initiatives with the purpose of identifying and preventing similar situations. Four specific initiatives were identified in Secretary Peña's letter. The second initiative, which is the subject of this report, can be summarized as follows:

> *DOE field offices must reassess known vulnerabilities (chemical and radiological) at facilities that have been shut down or placed in standby mode and facilities in the process of being deactivated. Facility operators must evaluate their facilities and operations for new vulnerabilities on a continuing basis.*

This report primarily concentrates on the reassessment of known vulnerabilities. Where appropriate, information on the methods used to identify and control vulnerabilities supplements the reassessment. The year-end progress report, which will address Secretary Peña's remaining initiatives, will more fully discuss the processes utilized to evaluate new vulnerabilities.

Over the past several years, DOE has conducted a series of assessments to identify environmental, safety, and health (ESH) vulnerabilities in areas of chemical, plutonium and highly enriched uranium (HEU) handling, storage and operations. As part of this preliminary reassessment, Y-12 vulnerabilities identified in those assessments have been reviewed. Responses to Defense Nuclear Facilities Safety Board (Defense Board) Recommendations were also included in the scope of the review as well as a review of applicable site and corporate assessments and audits. Information from facility walkdowns will be included in the year-end progress report.

All of the vulnerabilities identified in the DOE assessments have not been eliminated (roughly fifty percent remain open). Corrective action plans are under way. The status of these activities is included in this report (see Sections 1.1-1.4 and Appendix A). The risks associated with the open corrective actions do not present imminent dangers. Where necessary, compensatory measures have been established. In a number of cases, the corrective action plans developed to eliminate or reduce the vulnerabilities have been completed. These activities are also outlined in this report.

Since the voluntary stand down of operations in September 1994, Y-12 operations have undergone numerous reviews by DOE Headquarters, DOE Oak Ridge Operations, Y-12 Site Office, and the Defense Board. If a finding has been identified as part of these reviews, it is entered into the Plant's corrective action tracking system and tracked to completion. Presently, all major mission areas with the exception of Enriched Uranium Operations (EUO) have

undergone readiness assessments and been authorized to restart. EUO is undergoing a series of process-based Operational Readiness Reviews (ORR) which are scheduled to be completed in 1998 (Phase A) and 1999 (Phase B). EUO is presently allowed to conduct limited "special" operations. Actions taken for the readiness assessments and ORR have enhanced the discipline and rigor of the ESH programs at the Y-12 Plant. Plans have been established for those programs needing improvement.

This report presents a summary of Y-12 known vulnerabilities as identified in the designated DOE-led vulnerability studies and Defense Board reviews. A preliminary review of facility conditions was conducted earlier this summer in response to the Red Alert issued on May 28, 1997, for the Hanford explosion. This review did not identify any new vulnerabilities. Facility "walkdowns" intended to validate the earlier review are currently under way or have been completed. The facility managers have been asked to examine their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release. Particular emphasis is being placed on legacy chemicals and materials located in inactive facilities. Detailed instructions were developed for the conduct of these "walkdowns," including how Y-12 Facility Managers can identify time-dependent chemical hazards in the workplace as well as how to document the results. To date, no new vulnerabilities have been identified. The final results of these "walkdowns" will be included in the final response report to be submitted to DOE later this year.

Corrective actions are under way to eliminate or reduce the known vulnerabilities at the Y-12 Plant. Existing systems and processes are in place to prevent or resolve any future vulnerabilities that may arise. Funding will influence the ability and pace of the Y-12 Plant to eliminate all vulnerabilities; however, Y-12 is committed to the principles of integrated safety management of providing a safe workplace and performing work safely.

1. STATUS OF DOE VULNERABILITY REPORTS AND RECOMMENDATIONS

1.1 VALIDATION OF CONCLUSIONS FROM TOMSK SELF-ASSESSMENT

1.1.1 Background

On April 6, 1993, a sequence of events occurred at the Siberian Chemical Combine at TOMSK-7 in Russia that caused substantial physical damage to the facility. A runaway exothermic chemical reaction occurred in a large process vessel that contained a concentrated solution of uranyl nitrate, nitric acid, plutonium nitrate, residual fission products totaling approximately 560 Ci, and an undetermined amount of organic constituents derived from the solvent extraction process. This reaction produced a copious amount of flammable organic and inorganic gases and steam, which pressurized and burst the vessel; dislodged the concrete cell cover; and, it is believed, ignited in the area immediately above the cell.

In response to early reports of the incident, the Department of Energy (DOE) sent a team of experts to TOMSK-7 to learn the details of the incident and subsequently initiated a series of reviews at DOE sites to ensure that similar conditions do not exist in DOE processing vessels. In a February 23, 1994, letter to DOE Site Office managers, the DOE Oak Ridge Operations (ORO) Director of Safety and Health directed that a series of self-assessments be conducted based upon lessons learned from the TOMSK-7 incident.

The evaluation of safety concerns related to potential nitrate-organic chemical hazards at DOE facilities focused on nitrate-organic hazard vulnerabilities of all nitrate-organic materials, not just the nitric acid, heavy metal nitrates and extraction solvents. Included were waste storage tanks, ion-exchange resins, and other possible combinations of nitrate-containing solutions and organic compounds. The minimum quantity of material subject to the reviews was 25 liters to limit the scope of the review to chemical systems that could lead to either off-site or significant on-site consequences.

1.1.2 Conclusion

The DOE led task team identified no significant vulnerability at the Y-12 Plant in this area. The task team concluded that at Y-12 it is highly unlikely that a nitrate-organic reaction could occur. No systematic design defects or significant processing equipment deficiencies were noted. Waste storage tank issues were recognized as being well characterized with plans in place to monitor or remediate the flammability and reaction hazards present. No recommendations on the disposition of waste storage tanks or their contents were made. Ion-exchange resins that were exposed to nitrate media were being handled properly. Factors minimizing this probability include the absence of intense radiation fields as a factor in the production of degraded organics, room temperatures (other than in evaporators), visual observation of organic-aqueous phase separators, the venting of the systems to atmosphere, and other design and operation parameters

and procedures which are aimed at the elimination of the conditions of materials, temperatures, and pressures which contribute to “red oil” explosions.

The venting and the ambient temperatures of the solution storage systems at Y-12 reduce the risk of these small accumulations; however, the potential still exists for the accumulation of small amounts of degradation products resulting from extended periods of inoperation during which the acid aqueous and organic phase of system inventories are in contact with each other. Y-12 Operations continues to pay close attention to off-normal situations (such as the present stand down condition) to maintain the low probability of exothermic reactions. Shift management personnel facility rounds include inspection of the extraction systems for brown fumes, bubbles, and color or liquid level changes. No further actions in this area are deemed necessary.

1.2 VALIDATION/STATUS OF OPEN VULNERABILITIES FROM THE CHEMICAL VULNERABILITY ASSESSMENT

1.2.1 Background

On February 14, 1994, Secretary of Energy Hazel R. O’Leary directed the Office of Environment, Safety, and Health to lead a broad-based review to identify chemical safety vulnerabilities confronting DOE. These vulnerabilities represent circumstances of conditions that could result in fires or explosions from uncontrolled chemical reactions, exposure of workers or the public to hazardous chemicals, or release of hazardous chemicals to the environment.

Identified vulnerabilities and supporting observations were described in the *Chemical Safety Vulnerability Working Group Report* (DOE/EH-0398P). DOE/EH-0398P specified that applicable sites would prepare Comprehensive Response Plans to report their vulnerabilities and would address vulnerabilities requiring mitigation to comply with regulations, standards, and DOE directives. *The Comprehensive Site Response Plans to the Chemical Safety Working Group* (*Comprehensive Response Plans*) was issued October 25, 1995, under cover letter from Robert W. Poe, Assistant Manager for Environment, Safety, and Quality, to Joseph E. Fitzgerald Jr., Deputy Assistant Secretary for Worker Health and Safety, EH-5.

1.2.2 Generic Vulnerabilities for Chemical Safety

The DOE field verification portion of the Chemical Safety Vulnerability Review identified 35 facility- and site-specific vulnerabilities across the complex. Five facility-specific vulnerabilities were identified at the Y-12 Plant. The vulnerability and present status of that vulnerability are outlined in Section 1.2.3.

The DOE task team grouped the 35 complex vulnerabilities into eight generic vulnerabilities that had the potential to impact the DOE complex. Limited actions were identified in the *Comprehensive Response Plan* for the Y-12 Plant. The following sections describe the generic complex vulnerabilities, any actions required by the Y-12 Plant, and a summary of the plans and

programs utilized to prevent the development of the vulnerability at the Y-12 Plant. The year-end progress report will include information on any new chemical vulnerabilities that were identified during the facility walkdowns.

1.2.2.1 Unanalyzed Hazards

Generic Complex Vulnerability: "Many facilities and activities have not been thoroughly analyzed for the presence and magnitude of hazards associated with the use of chemicals. Failure to recognize and analyze such hazards increases the risk of personnel exposures and environmental releases due to accidents such as fires or explosions."

Actions Required in Comprehensive Response Plan: No specific action identified for the Y-12 Plant.

Program Summary: In addition to the application of the actions taken as a result of Secretary Peña's initiatives in response to the May 14, 1997, explosion at the Hanford Plutonium Reclamation Facility, four programs are primarily directed to the thorough analysis of the presence and magnitude of hazards associated with the use of chemicals: application of the Process Safety Management (PSM) requirements (29 CFR 1910.119) and the Risk Management Program (RMP) (40 CFR 68) when applicable, the Safety Analysis Program (implementation of DOE Order 5480.21, 5480.22, and 5480.23), and the TOMSK Lessons-Learned Program.

At Y-12, quantities and concentrations of hydrogen chloride have been identified as being covered by RMP. Management fully intends to comply with rule requirements within the designated time limits specified in the rule. In the future, hydrogen fluoride is expected to be utilized in quantities sufficiently large to be covered by both the PSM and RMP rules. Requirements of both rules will be met prior to the introduction of the hazardous chemical.

1.2.2.2 Past Chemical Spills

Generic Complex Vulnerability: "Many facilities have experienced spills and releases of hazardous chemicals to the soil. Known incidents have been identified and characterized in some cases. Additional spill or discharge areas may be discovered. Both known and unknown contaminated soil could pose hazards to workers as construction, environmental restoration, and decontamination and decommissioning activities increase."

Actions Required in Comprehensive Response Plan: No specific action identified for the Y-12 Plant.

Program Summary: Several programs at the Y-12 Plant contribute to the adequate control of past chemical spills. These include the National Pollution Discharge Elimination System (NPDES) Program, the Occurrence Reporting and Processing System (ORPS), the Resource Conservation

and Recovery Act (RCRA) Program, the Groundwater Monitoring Program, and the Environmental Restoration Program (ERP).

The purpose of ERP is to cost effectively and safely eliminate or reduce to prescribed levels the risks posed to human safety and the environment by radioactive and/or hazardous contaminants at inactive sites and Decontamination and Decommissioning (D&D) facilities managed by ORO. This program implements the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process as prescribed in the Federal Facilities Agreement for the Y-12 facility. All facilities are required to undergo an investigation to determine the extent of contamination as a first step toward cleanup. Next, the cleanup options are identified and evaluated. An approach is selected, designed and implemented based on the identified hazards. The facilities are prioritized and addressed as resources are available. Currently D&D activities are included in ERP. A major portion of this program is surveillance and maintenance (S&M) aimed at maintaining the facilities in a safe manner until decontamination and decommissioning is possible.

1.2.2.3 Characterization of Chemicals

Generic Complex Vulnerability: "Many hazardous materials found at DOE facilities have not been adequately characterized to determine the types or quantities of the chemicals they contain or the potential risks they represent. This situation increases the likelihood of worker exposure to these materials resulting from lack of knowledge about where they are located, the specific hazards they pose, and the actions necessary to prevent or mitigate such hazards. The presence of these materials increases the risk of worker exposures during the conduct of routine and nonroutine operations (e.g., during decontamination and decommissioning activities at facilities containing residues, during emergency response efforts in areas containing uncharacterized hazards, or because of the increased potential for accidents resulting from the storage of incompatible chemicals)."

Actions Required in Comprehensive Response Plan: No specific action identified for the Y-12 Plant.

Program Summary: The Y-12 Plant continues to apply programs which lead to the identification and characterization of hazardous chemicals. The Safety Analysis Program plays a primary role in this endeavor. Additionally, all waste accepted for treatment, storage, and disposal must be characterized in accordance with applicable procedures. Facility "walkdowns" are currently under way. Facility managers have been asked to (1) verify their chemical inventories are up-to-date, (2) examine their storage of any chemicals that have the potential for explosion, fire, or significant toxic release and (3) identify any excess or residual chemicals. To date, no new vulnerabilities have been identified.

1.2.2.4 Planning for Disposition of Chemicals

Generic Complex Vulnerability: "DOE has significant quantities of hazardous and specialty chemicals that are no longer required to support ongoing activities. DOE facilities also have a wide range of smaller quantities of laboratory chemicals. At many sites, there is little incentive to reduce the inventory of chemicals that are no longer needed. The lack of systematic inventory planning and control increases DOE's overall vulnerability to worker exposures and environmental releases. Furthermore, chemicals held in the absence of continuing need may be viewed as waste by Federal and State regulatory agencies and could be subject to the requirements of RCRA."

Actions Required in Comprehensive Response Plan: Elimination of the excess inventory of nitrogen tetraoxide (N_2O_4) and hydrogen fluoride. Continued safe storage and monitoring of mercury and lithium inventory owned respectively by the Defense Logistics Agency and Defense Programs.

Status: The excess inventory of N_2O_4, approximately 1700 pounds, and hydrogen fluoride, approximately 11,000 pounds, has been sold since the DOE Chemical Safety Vulnerability Assessment was conducted resulting in a corresponding reduction in risk to the worker and environment. The reduction of the hydrogen fluoride inventory represents one of the most significant ESH accomplishments for the Y-12 Plant, reducing the potential for an industrial accident resulting in significant multi-person injuries or fatalities.

Program Summary: There remain four primary programs at the Y-12 Plant that contribute to the safe disposal of excess or unneeded chemicals: The Waste Site Identification and Characterization Program, the Safety Analysis Program, the Swap Shop, and the Hazardous Materials Information System (HMIS) Excess Materials List. The Waste Site Identification Program provides guidance for the initial identification and characterization of previously unidentified waste sites in order to determine the responsible organization and the required actions to be accomplished in accordance with regulatory and Energy Systems guidelines. In all phases of the Safety Analysis Program, a strong emphasis is place on Risk Reduction Action Plans. The Swap Shop, a computer-based bulletin board, provides a means for identifying and advertising surplus materials, including chemicals, which may be of use to other plant organizations.

1.2.2.5 Chemical Storage Practices

Generic Complex Vulnerability: "Improper chemical storage practices are in use at many DOE facilities. Appropriate chemical storage practices should consider such factors as the adequacy and integrity of chemical containment (e.g., tanks, drums, secondary containment), segregation of incompatible chemicals, ventilation, temperature and humidity controls, fire protection, and protection from weather. A reluctance to dispose of inventories of hazardous materials that are no longer needed has exacerbated problems associated with the storage of chemicals. Further,

chemicals are often stored in aging facilities that are neither properly designed nor equipped for chemical storage."

Actions Required in Comprehensive Response Plan: No specific actions were identified for the Y-12 Plant**.** Commitment was made by LMES to continue implementation of the Safety Analysis Report Update Program (subsequently replaced by implementation plan for DOE Orders 5480.22 and 5480.23).

Status: Basis of Interim Operations have been completed for most nuclear and moderate hazard facilities at the Y-12 Plant. A schedule has been submitted to DOE for improvements to the Y-12 authorization basis documents.

Program Summary: Several practices at Y-12 continue to support the safe storage of chemicals: the Hazardous Material Storage and Inspection procedures, management of hazardous waste in satellite accumulation points and 90-day accumulation areas, chemical storage practices within Waste Management facilities, application of controls identified through the Safety Analysis Program, and implementation of fire protection policies. Energy Systems Hazardous Material Storage and Inspection procedures provide management guidelines for storage and inspection of toxic and hazardous materials as part of the comprehensive Hazardous Materials Management Program. The Y-12 Plant implements procedures to provide for the proper management of hazardous wastes from point of generation until such time as they are treated and/or disposed of in approved, permitted facilities. In Waste Management facilities, hazardous wastes or hazardous portions of a mixed waste are managed in accordance with federal, state, and local statutes and regulations. As part of the Safety Analysis Program, where disposal of hazardous chemicals is not appropriate, other methods such as improved containment or segmentation are identified to improve safety to the extent practical.

1.2.2.6 Condition of Facilities and Safety Systems

"The structural deterioration of many DOE facilities in which chemicals are stored, handled, or processed increases the potential for worker exposures and environmental releases involving hazardous chemicals. In many instances, safety and essential support systems (e.g., utilities and ventilation systems) have not been effectively maintained, thus decreasing the margin of protection provided to workers, the public, and the environment against chemical hazards. Deficiencies due to inadequate maintenance budgets and the change in DOE mission have resulted in an increased number of 'surplus' facilities (i.e., facilities declared by DOE program offices to be available for other uses)."

Actions Required in Comprehensive Response Plan: No specific actions were required by the Y-12 Plant.

Note: The Highly Enriched Uranium (HEU) Vulnerability Study was also concerned with this area. See Section 1.3 for issues/vulnerabilities identified in that study.

Program Summary: The Safety Analysis Program at the Y-12 Plant categorizes facilities in accordance to a DOE-approved categorization process. Safety analysis documents for the identified hazardous facilities designated those structures, systems, and components required for safety. Y-12 also maintains an effective Industrial Safety Program that utilizes safety work permits to provide for the evaluation and control of potential or actual hazards associated with the performance of specified work whenever the presence of special or unusual hazards endanger the safety of personnel. The Industrial Hygiene Program also functions to identify, evaluate, and control environmental factors and stresses found in the workplace. Y-12 maintains an integrated management process that ensures that the physical and functional arrangement of selected configuration items meet requirements throughout facility life cycles. The Facility Transition Program is responsible for identifying surplus facilities, materials and equipment. Once identified, the program is also responsible for identifying and prioritizing ESH risks associated with those facilities/capability units and mitigating any remaining high risks including any associated with structural deterioration.

1.2.2.7 Abandoned and Residual Chemicals

Generic Complex Vulnerability: "As facility missions changed or were terminated, chemical inventories were often left in place; tanks, pipes, and other equipment were not flushed to eliminate chemical residues. These conditions have created vulnerabilities that are exemplified by workers inadvertently coming into contact with hazardous chemicals or chemical residues, particularly during decontamination and decommissioning operations; by increased public access to areas and facilities containing chemical hazards; and by environmental releases of hazardous chemicals due to degradation of abandoned facilities or equipment."

Actions Required in Comprehensive Response Plan: No specific actions were required by the Y-12 Plant.

Program Summary: The Y-12 Plant continues the implementation of programs, initiatives, and procedures to ensure that abandoned and residual chemicals are properly identified, controlled, and/or removed. Such programs include the Environmental Restoration Program, Project Planning and Construction Procedures, RCRA, and Emergency Preparedness Planning. Additionally, a renewed campaign (discussed earlier) has been initiated as a result of a campaign to respond to Secretary Peña's initiative resulting from the Hanford explosion. The Facility Transition Program is responsible for managing the safe and compliant deactivation of surplus facilities/capability units including the mitigation of high ESH risks. Facility/capability unit assessments are utilized to identify possible ESH risks which may include abandoned or residual chemicals.

1.2.2.8 Inventory Control and Tracking

Generic Complex Vulnerability: "Although most DOE sites have systems in place to record and monitor on-site chemical inventories, some systems do not provide up-to-date information on chemical quantities and locations. The absence of comprehensive inventory control systems creates the potential for exposure of workers to hazardous chemicals that are not known to be present; fires and explosions due to mixing co-located, incompatible chemicals; and diminished effectiveness of emergency response plans due to unidentified chemical hazards."

Actions Required in Comprehensive Response Plan: No specific actions were required by the Y-12 Plant. A commitment was made by LMES to implement HMIS.

Status: Once the information developed in the facility walkdowns is entered into HMIS, the system will be fully implemented across the Y-12 Plant. The data entry is projected to be completed in the first quarter of CY1998. A recent audit, conducted in October 1997, found that, where implemented, the inventories and records are accurate.

Program Summary: There are two primary programs at Y-12 that ensure effective control and tracking of chemical inventories: HMIS and the Waste Tracking System. HMIS is a sitewide electronic data base for the tracking and control of hazardous chemical inventories. It supports the health and safety needs of multiple Y-12 ESH programs. The Waste Tracking System is a comprehensive facility-wide system that tracks waste from generation to disposal.

1.2.3 Site-Specific Vulnerabilities

During the field verification phase of the review, selected sites were identified to verify the accuracy and completeness of information provided by field self-evaluations. The Oak Ridge Reservation, including the Y-12 Plant, was included in the field verification effort. Five vulnerabilities identified below resulted from this review at Oak Ridge. Summaries of current conditions and programs which address the Y-12 vulnerabilities are provided.

1.2.3.1 CSVR-OR-ORR-01: Uncharacterized areas containing potentially hazardous materials are increasingly accessible

Oak Ridge-Specific Vulnerability: "Security areas at the Oak Ridge sites are shrinking as programs are cut back. The costs of maintaining such areas are high, and the Department's increased openness promotes reduction in controlled areas, consistent with changing missions. Other access control measures, both administrative and physical, will diminish over time. At Oak Ridge, all facilities and operations have been subjected to at least a preliminary hazards screening. However, excess and abandoned facilities/sites that may not have been fully evaluated and characterized will become available for access by workers and the public. As this occurs, many individuals will not know the history of the facility/site, nor will they be aware of the real or potential hazards that may be present. The possible exposure of workers and the public to hazardous and/or toxic materials, environments, and situations without their knowledge or consent represents a high-priority vulnerability with a potential for short-term consequences."

Status: This is not a vulnerability at the Y-12 Plant. Building 9201-4 remains the only facility undergoing remediation at the Y-12 Plant. It continues to be separated from the public by a guarded, alarmed fence as well as an administrative barrier requiring badge-reader access. Personnel entering the facility must have HAZWOPER/GET training or be escorted. Where hazardous materials have escaped into the surrounding soils, barriers have been erected to control access. Excavation is allowed only after careful work planning, including the identification of appropriate protective equipment and/or administrative controls. The Facility Transition Process will be utilized to ensure safe and compliant deactivation of additional facilities and capability units identified as surplus.

1.2.3.2 CSVR-OR-ORR-02: Chemicals are stored in facilities not designed for that purpose

Oak Ridge-Specific Vulnerability: "Buildings and equipment are being used for purposes for which they were not intended or beyond their expected life. Some cylinders used for storing uranium hexafluoride have failed in the recent past, releasing small quantities to the atmosphere. The process of aging will accelerate as cylinders reach the end of their functional life. The storage of 23.6 million pounds of lithium hydroxide — plus smaller quantities of low-level radioactive waste, other hazardous chemicals, and chemical residuals — in steel drums represents another potential hazard. Storage areas currently being used have no climate control; thus, the drums are subject to the long-term effects of corrosion due to diurnal and seasonal extremes of temperature and humidity. Projects for storage facilities have been proposed but have not been funded. These conditions and circumstances represent a medium-priority vulnerability with a potential for medium-term consequences."

Status: This remains a potential vulnerability at the Y-12 Plant; however, based upon engineering judgment the risk is low. The Y-12 Plant continues to store large quantities of mercury in Building 9720-26. The mercury is contained in metal cylinders stored on a sealed, diked floor. Although the present storage arrangement is considered to be safe, a safety analysis for this facility is planned when funding becomes available.

1.2.3.3 CSVR-OR-ORR-03: Facilities were placed in caretaker status without appropriate cleanup or documentation

Oak Ridge-Specific Vulnerability: "When a facility changes from operational to caretaker status without thorough cleanup operations, chemicals left in the facility can represent a potentially hazardous condition and/or environmental concern. Such chemicals may be hazardous in their original state or as degradation products that result over time. Chemicals and/or their degradation products may also cause damage to equipment or structures or be affected by building or container deterioration due to natural aging. The loss of corporate memory (e.g., as a result of personnel transfers and retirements, facility aging, downsizing, multiple usage, and inadequate configuration management and record keeping in the past) may result in chemical hazards when new operations are attempted. The potential for fire, employee exposure,

inadvertent releases to the atmosphere, and higher cleanup costs represents a medium- to high-priority vulnerability with a potential for short- to long-term consequences."

Status: Major/obvious vulnerabilities have been ameliorated. Characterization of Building 9201-4 was completed in 1994; however, future use and cleanup acceptance criteria remain unknown. The decision on how far decontamination and decommissioning will be performed remains unknown and is dependent on program funding and direction. There are no present plans to use the facility as a chemical storage facility. Recovered mercury was flasked and moved to Building 9720-26 for storage. As other facilities or capability units are identified as surplus, the Facility Transition Process will require the performance of a deactivation walkdown assessment to determine deactivation requirements. This assessment will be used to identify health and safety concerns as well as pollution prevention opportunities using facility walkdowns and interviews with persons knowledgeable about the facility and processes conducted within that facility. These assessments will be analyzed to determine the actions necessary to place the facility or capability units in a safe and compliant condition.

1.2.3.4 CSVR-OR-ORR-04: Inconsistent formality and rigor are applied to the management of hazardous materials

Oak Ridge-Specific Vulnerability: "Use of the Hazardous Materials Information System for chemical inventories is an effective tool for enhancing safety and control, but it is not used in all facilities at Oak Ridge. Chemical inventories (e.g., lithium hydroxide, uranium hexafluoride) in long-duration storage are currently stable and pose normal industrial hazards, but the risk could increase during extended storage as containers and facilities deteriorate. Funds requested to upgrade storage conditions have not been obtained. Funds have been proposed to upgrade storage conditions, but in the absence of regulatory drivers, some projects have not had sufficient priority. Hazardous materials in some laboratories are excluded from the more rigorous controls specified for some other facilities. Casual handling and housekeeping practices in some laboratories are inconsistent with site procedures, DOE 5480.19, and 29 CFR 1910.1450. These conditions and circumstances represent a medium-priority vulnerability with a potential for short- to long-term consequences."

Status: Full implementation of HMIS has not been completed. Once the information developed in the facility walkdowns is entered into HMIS, the system will be fully implemented across the Y-12 Plant. Data entry is projected to be completed in the first quarter of CY1998. A recent audit, conducted in October 1997, found that, where implemented, the inventories and records are accurate. More information on this issue will be included in the year-end progress report.

As part of the actions in response to Secretary Peña's initiative, Y-12 managers were directed to "walk their spaces" to reassess facility hazards. Guidance was provided to assist in the evaluation of incompatibility of chemicals. Managers were also directed to expedite the annual revision to HMIS. The Y-12 Plant relies on HMIS for tracking the acquisition, storage, and use of hazardous chemicals.

The ongoing preparation for the ORR for EUO and readiness assessments for the remaining major mission areas have increased the rigor and formality of Y-12 operations. Prior to resumption, the procedures and associated training for each mission area were upgraded. In preparation for the ORR, EUO procedures and training are also being upgraded. In addition, a site Conduct of Operations manual was issued to ensure appropriate rigor and formality continues to be applied to Y-12 operations.

1.2.3.5 CSVR-OR-ORR-05: Large quantities of specialty and other industrial chemicals are stored without consistent strategic planning

Oak Ridge-Specific Vulnerability: "This potential vulnerability involves the storage of bulk quantities of unique chemicals that are now surplus to national defense programs. Chemicals stored at Y-12 and K-25 include lithium and its compounds, beryllium and its compounds, uranium hexafluoride, and mercury. Over time, unanticipated chemical hazards may result from the storage of these chemicals in temporary facilities. Chemical aging, which degrades the material to unknown byproducts, represents another potential hazard. The storage of this material also represents a long-term economic commitment by DOE. These conditions and circumstances represent a medium-priority vulnerability with a potential for medium- to long-term consequences."

Summary: This remains a vulnerability; however, actions have been taken to reduce the risk. The excess inventory of hydrogen fluoride, approximately 11,000 pounds, and N_2O_4, approximately 1700 pounds, has been sold. Beryllium and lithium compounds continue to be part of the chemical inventory. Defense Programs retains ownership of the material. Any decision regarding the disposition of the stockpile will be made by DOE. A Basis for Interim Operation document (YEMG/BIO-009) serves as the authorization basis for the facility. A follow-on Safety Analysis Report is presently under DOE review for approval.

Large quantities of mercury continue to be stored in Building 9720-26 for the Defense Logistics Agency as well as the DOE. The inventory will continue to be reintroduced into the commercial mercury market in a controlled manner, thus reducing the hazards from storage of the material at the Y-12 Plant.

1.3 VALIDATION/STATUS OF OPEN VULNERABILITIES FROM HIGHLY ENRICHED URANIUM VULNERABILITY ASSESSMENT

1.3.1 Background

In March 1994, Secretary of Energy Hazel R. O'Leary directed DOE to conduct an assessment of ES&H vulnerabilities associated with the storage of weapon-usable fissile materials across the DOE complex. The ES&H vulnerability assessment for HEU storage was initiated by the Secretary in February 1996 and was completed in August 1996.

HEU is defined as uranium at least 20 percent of which is the fissile isotope uranium 235 (U-235). The potential for ES&H vulnerabilities associated with HEU at the Y-12 Plant was assessed. This assessment, performed by a team of the site's technical experts, consisted of document research, personnel interviews, and facility walkdowns. The Self-Assessment Team (SAT) results were subsequently validated by a DOE-HQ Working Group Assessment Team. *The Highly Enriched Uranium Working Group Report*, DOE/EH-0525 (Vol. I: Summary and Vol. II: No. 1), was reviewed during this reassessment.

1.3.2 Findings

A total of 49 ES&H vulnerabilities were identified for the Y-12 Plant as part of the assessment: 20 associated with facility condition, 9 with material/packaging, and 20 institutional issues. Vulnerabilities identified included:

- The potential for fire in various buildings, resulting in the off-site releases of enriched uranium. Although considered to be a low probability, the condition is aggravated in some buildings by the presence of combustible materials, the absence in some areas of protective sprinklers and fire protectors, and/or the established pyrophoricty of finely divided uranium metal.

- Vulnerabilities relating to enriched uranium storage, including the construction and condition of storage facilities, the quality and condition of packaging, and recognition that due to the age of Y-12 facilities, none of the Y-12 Plant storage facilities meet the current DOE criteria for new storage facilities.

- Buildings involved in enriched uranium operation are all relatively old and built to standards that were not well documented. Some of the buildings and equipment have not been completely analyzed as to their ability to withstand natural phenomena events.

- Maintenance problems, such as inleakage of rain water and process liquid leaks, were widely present. There was a substantial backlog of building and equipment maintenance tasks.

- Many buildings with a long history of uranium processing have accumulated uranium contamination that is difficult to remove.

- Shortcomings in the conduct of operations, which were the underlying cause of the stand down, were still in evidence.

- Chemical reactions, especially those between HEU and water.

- The accumulation of a large number of stored items in some buildings, including radiologically contaminated wasted.

- Accumulation of material in process and waste material, exacerbated by the long downtime.

1.3.2 Corrective Action Status

The 49 ES&H vulnerabilities resulted in the identification of 111 corrective actions. To date, 79 actions have been closed. Progress continues to close those remaining. Tables A.1-A.3 of Appendix A present the status of each vulnerability identified in the *HEU Vulnerability Report*.

1.3.3 Discussion of Vulnerabilities and Associated Risks

As detailed in the HEU Vulnerability Report and the Self-Assessment Team Reports, most of the identified vulnerabilities result in relatively low risk to workers, the environment, and the public. Most of the vulnerabilities have a low to very low probability of occurring. See *HEU Vulnerability Report* for further information on the methodology utilized to assign risks to the vulnerabilities. For those vulnerabilities identified as having a higher likelihood, most generated low consequences to the worker and below threshold consequences to the public and the environment. Only SAT-003/GEN, uranium contamination, and SAT-005/GEN, potential leaks and spills, were rated as having a high likelihood with medium consequences to the environment (SAT-003) or the worker (SAT-005). While the corrective action plans for these vulnerabilities are still open, signficant progress has already been made. See Sections 1.3.3.1 and 1.3.3.2 below.

1.3.3.1 SAT-003/GEN

With the implementation of the Site Radiological Control Manual, the risk of environmental release has been greatly decreased through contamination surveys and remediation. In addition, a comprehensive Y-12 Plant Decontamination Plan has been developed and decontamination work has been completed on the docks identified in Y/DQ-74, *Y-12 Radiological Docks - Assessment and Decontamination Priority Plan.*

1.3.3.2 SAT-005/GEN

A number of actions have been taken to mitigate the consequences of a spill or leak including a surveillance program to review carbon steel cans for corrosion and to replace them with stainless steel cans. Facility modifications have been made during the last five years to those areas where a leak is most likely. Improvements have been made to building room air sampling systems used to monitor airborne radiological contamination in HEU processing areas.

1.4 VALIDATION/STATUS OF OPEN VULNERABILITIES FROM PLUTONIUM VULNERABILITY ASSESSMENT

1.4.1 Background

In March 1994, Department of Energy Secretary Hazel R. O'Leary commissioned a comprehensive assessment to identify and prioritize the environment, safety, and health vulnerabilities that arise from the storage of plutonium in the Department of Energy facilities and determine which are the most dangerous and urgent. The assessment was commissioned because of ruptures of stored plutonium packages and the need to store safely the large amount of plutonium-bearing materials held by the Department in its aging facilities. The results of this assessment were published in DOE/EH-0415, *Plutonium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage*, dated November 1994.

1.4.2 Status

For those areas operated by LMES, today, no vulnerability exists at the Y-12 Plant in regards to plutonium. The *Plutonium Vulnerability Study* identified three buildings at the Y-12 Plant site with potential plutonium vulnerabilities, Buildings 9212, 9213, and 9204-3. (Building 9204-3 is operated by Lockheed Martin Energy Research [LMER]. The LMER response to Secretary Peña's initiative should be consulted relative to this report and any associated vulnerabilities).

According to the *DOE Plutonium Vulnerability Report*, DOE does not give sites with lesser plutonium holdings the level of attention it gives to sites with large holdings since low inventory generally signifies low hazard. Nevertheless, releases of plutonium from such facilities can also present hazards to workers, the public, and the environment. Hazards at sites with low plutonium inventories may be reduced by consolidating unneeded plutonium materials at larger sites.
Since the time of the vulnerability study, material in the form of plutonium sources formerly stored in Building 9213 has been transferred to Building 9983, the Sealed Source Storage Facility. Building 9212 still maintains a few sealed sources containing PuBe (total of 1.040 kg) and a few AmLi sources needed for operational purposes. The sources in Buildings 9983 and 9212 do not pose any significant consequences due to routine material checking, their protected location, and encapsulation.

1.5 REASSESSMENT/STATUS OF DEFENSE BOARD RECOMMENDATIONS

Several Defense Board recommendations are applicable to the Y-12 Plant for this evaluation including:

- Defense Board Recommendation 93-3, *Improving DOE Technical Capability*,
- Defense Board Recommendation 93-6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*,

- Defense Board Recommendation 94-4, *Deficiencies in Criticality Safety at Oak Ridge Y-12 Plant*, and

- Defense Board Recommendation 95-2, *Safety Management*.

1.5.1 Safety Management

While the following recommendation does not identify a vulnerability; it has the potential to impact the identification and control of potential vulnerabilities. Therefore, it is included in this reassessment.

Defense Board Recommendation 95-2, *Safety Management*, was issued on October 11, 1996. DOE summarized the Board's desires as

> "...1) an institutionalized process for ensuring environment, safety, and health requirements are met, 2) safety management plans for conduct of operations, tailored based upon risk, 3) a prioritized list of facilities/activities based on hazards and importance, 4) direction and guidance for the integrated safety management system, and 5) measures to ensure the Department has or will acquire the necessary technical expertise to effectively implement the process."

Status: In response, Y-12 has submitted a description of the proposed Integrated Safety Management Plan (ISM) to the Y-12 DOE Site Office for their review. A draft procedure based on the Y-12 ISM has been developed. Enhancements are under way to existing programs to support full implementation of the plan. ISM will be more fully discussed in the year-end progress report.

1.5.2 Criticality Safety/Conduct of Operations

Recommendation 94-4 was issued due to the concerns raised at the time of the voluntary stand down at the Y-12 Plant. These concerns questioned the degree of implementation and rigor of the Criticality Safety and Conduct of Operations Programs. These issues were identified in the *HEU Vulnerability Study* as vulnerabilities.

Status: The DOE Implementation Plan developed to address Recommendation 94-4 established a series of task teams to review the Y-12 Criticality Safety and Conduct of Operations programs and make recommendations. These teams have completed their reviews and identified a series of deficiencies and improvements related to these programs. Corrective action plans were developed to address these findings and are being tracked. Quarterly status reports are provided to the Defense Board and available on the DNFSB DOE Liaison Page on the World Wide Web.

1.5.3 Technical Capability

As identified in the third initiative of Secretary Peña's August 4, 1997, letter and the *Chemical Vulnerability Study*, technical knowledge and competency are key aspects to understanding the past use and condition of a facility and evaluating the hazards presented by materials in that facility. Therefore, the following recommendations were considered as impacting chemical and radiological safety.

1.5.3.1 Defense Board Recommendation 93-6

The Defense Board issued Recommendation 93-6 on October 10, 1993, to "draw attention to the need to retain access to capability and capture certain critical defense nuclear activities, in order to avoid future safety problems in these and related activities."

Status: This recommendation is considered closed. A knowledge preservation program was initiated at the Y-12 Plant. Present and past employees were videotaped to capture their knowledge and understanding of past processes and operations. A program has been established to capture information from key personnel as they retire. Therefore, this is not considered to be a vulnerability.

1.5.3.2 Defense Board Recommendation 93-3

The June 1, 1993, Defense Board Recommendation 93-3 outlines concerns about the ability to recruit and retain adequately qualified personnel to ensure safe operation of defense nuclear facilities. As part of its implementation plans, DOE promised to put renewed emphasis on ensuring the implementation of DOE Order 5480.20A dealing with training and qualification of nuclear workers. This was also identified as a vulnerability in the *HEU Vulnerability Study.*

Status: The Y-12 Training and Qualification Program for nuclear workers is described in Y/GA-66/R6, *Y-12 Plant Training Implementation Matrix (TIM) for DOE Order 5480.20A*, including the schedule for reaching full compliance. It should be noted that personnel are permitted to work only on operations for which they have completed the appropriate qualification program; therefore, while the TIM has not been fully implemented, the risk of this vulnerability is considered to be significant. The Training and Qualification Program will be more fully discussed in the year-end progress report.

1.5.4 Defense Board Trip Reports

Since the stand down in 1994, Defense Board staff members have periodically reviewed Y-12 operations and issued trip reports on their conclusions. Recent trip report conclusions with chemical or radiological safety implications include:

- Limited progress in resolving deficiencies in the preventative maintenance (PM) program.

Status: An 80 percent decrease in overdue items has been experienced since dedicated personnel have been assigned to assist in the reduction of overdue PM items. PM frequencies to meet operational needs have been reevaluated. Scheduling, tracking, and record keeping have been improved.

- Lack of comprehensive job hazard analysis on maintenance jobs in EUO.

  Status: Y-12 Plant Procedure Y10-012, *Requesting Maintenance Services*, is being revised to (1) ensure job hazard analysis is completed prior to job planning, (2) designate operations as the responsible party for leading the job hazard screening process, and (3) provide a revised screening checklist to assist in the analysis.

- Deficiencies in EUO authorization basis documents and controls developed based upon those documents.

  Status: As part of the restart effort, a new BIO and Operational Safety Requirements Document have been developed for Building 9212. As each process is restarted, the responsible process engineer is tasked with reviewing the authorization basis documents and identifying where the requirements are captured in Energy Systems or Y-12 controls/command media including plant and operating procedures. Eventually, this information will be captured and maintained electronically in a linking data base.

- Combustible levels in Building 9212.

  Status: Since the issuance of these trip reports, action have been taken to reduce the level of combustibles in Building 9212, particularly the E-Wing basement where compensatory measures have now been removed.Condition of the fire protection systems in Building 9212.

- Condition of the fire protection systems in Building 9212.

  Status: The sprinkler system was reviewed by Fire Protection Engineering, Central Engineering Services, and the EUO process engineers. The review indicated no significant erosion of outer piping. Piping has been cleaned, primed, and painted.

1.6 PRICE-ANDERSON AMENDMENTS ACT (PAAA) POTENTIAL NONCOMPLIANCES

As of October 30, 1997, the Y-12 Plant has reported 24 potential PAAA noncompliances. Five potential noncompliances have been reported to the DOE Noncompliance Tracking System (NTS) as potentially significant. The remainder have been reported as potential minor noncompliances. These deficiencies are handled within the normal corrective action process.

Both significant and minor potential PAAA noncompliances are identified in the internal tracking system and corrective action plans are tracked to completion. Tables B.1 and B.2 of Appendix B summarizes the potential PAAA noncompliances with chemical or radiological safety implications.

1.7 STATUS OF SEISMIC EVALUATIONS AT THE Y-12 PLANT

There are two DOE directives which trigger evaluations to determine the seismic safety of buildings at the Y-12 Plant. One directive is the EO 12941, *Seismic Safety of Federally Owned or Leased Buildings,* and the other directive is DOE Order 420.1, *Facility Safety.*

Executive Order (E0) 12941 requires federal agencies to develop an inventory of their buildings; evaluate the seismic safety of the buildings, and prepare cost estimates for mitigating unacceptable risks for buildings in that inventory. DOE Headquarters issued the *DOE Management Plan to Implement EO 12941* as the guidance for DOE sites to follow. The DOE management plan defines four phases for the implementation of EO 12941. These phases are the (1) inventory, (2) evaluation, (3) cost estimation, and (4) report.

The implementation of the requirements in EO 12941 was initiated in October 1997 and will be completed in January 1998. The inventory phase will define the buildings which are exempt from the EO 12941 and the nonexempted buildings. The model building types of the nonexempted buildings will be determined and evaluations will be performed of a sample of buildings from each model building type identified at the Y-12 Plant. Past seismic evaluations at Y-12 and evaluations of similar buildings at other sites will be used as part of the evaluation.

The EO 12941 seismic evaluations are primarily focused on (1) the life safety of the occupants in case of a collapse of the building and (2) determining cost estimates. The number of all federally owned or leased buildings which are determined to be seismically deficient and the cost estimates for mitigating the seismic risk of the buildings will be used to established future national public policy.

The DOE Order 420.1 directive is primarily focused on the potential release of hazardous materials which could effect the general public off site and the workers on site. More rigorous seismic evaluations are required to evaluate the buildings plus the equipment and components inside the buildings which are involved with processing or storage of hazardous materials. Safety Analysis Reports (SARs) are prepared which require the seismic evaluations. Many existing SARs at the Y-12 Plant are in the process of being updated. The SARs will address the vulnerability of chemical storage at the Y-12 facilities and consider the seismic vulnerability of the facilities. The evaluations performed as part implementing the EO 12941 will be utilized, as appropriate, to support the SARs.

1.8 ISSUES MANAGEMENT

To ensure issues were being effectively recognized and resolved, a Y-12 Issues Manager was appointed in 1996. Information that is factored into the issues management process include DOE Monthly Assessments and Y-12 self-assessments. Corrective action plans are developed and tracked for identified deficiencies. The Issues Manager produces an Issues Management Report annually to describe major programmatic issues at the Y-12 Plant that have been identified over the past year. This report was reviewed to identify any specific issues that could impact chemical/radiological safety. Specific issues identified in the Issues Management Report[1] include:

- Not all facilities have completed facility hazard assessments, facility emergency planning, or management self-assessments as required.
- Y-12 Plant personnel continue to work with increasing attention to dikes around storage tanks and transfer stations to bring them up to modern standards.
- Document control needs to be improved.
- Programmatic weaknesses in the fire protection program need to be resolved.
- Adverse trend has been identified in work controls.

Tables C.1 and C.2 of Appendix C provides an overview of issues that have been identified. Issues management plans are approved by DOE. Any changes to the plans must receive DOE approval.

1.9 RED ALERT - CHEMICAL EXPLOSION AT HANFORD

In response to the chemical explosion at Hanford, LMES released Red Alert Number R-1997-OR-LMESCENT-0501 on May 28, 1997. This alert requested each LMES organization to review their vulnerability assessments, issues identified in the alert and other assessments/surveillances to ensure that the organization understood the hazards of its chemical inventory and was taking appropriate actions in response. To date, no new deficiencies have been identified.

[1] This list and the associated table excludes issues previously identified in earlier vulnerability summaries including Conduct of Operations, Preventative Maintenance, Criticality Safety and Safety Analysis Programs.

2. CONCLUSION

Corrective actions are identified and under way to eliminate or reduce the known vulnerabilities at the Y-12 Plant. Existing systems and processes are in place to detect existing vulnerabilities or prevent or resolve any future vulnerabilities that may arise. Funding will influence the ability and pace of the Y-12 Plant to eliminate all vulnerabilities; however, Y-12 is committed to the principles of integrated safety management of providing a safe workplace and performing work safely as evidenced by the actions and programs that address the vulnerabilities outlined in this report including the elimination of the excess inventory of hydrogen fluoride and N_2O_4. The reduction of the hydrogen fluoride inventory represents one of the most significant ESH accomplishments for the Y-12 Plant, reducing the potential for an industrial accident resulting in significant multi-person injuries or fatalities.

Appendix A
Detailed Status Report on HEU Vulnerabilities

Table A.1 – Canceled/Closed HEU Vulnerabilities Action Plans

VAF Number	Facility	VAF Description	Internal Issue Number	Status	Closure Date
WGAT-002	Institutional	Changes to facility operations not always reflected in safety authorization bases	I33477	Canceled	05/13/1997 (date of cancellation)
SAT-003	9206	Characterization lacking for contamination in abandoned, underground ventilation system.	I33439	Closed	08/05/1997
WGAT-004	9212/9206	Inadequate storage practices for bottles of HEU liquids leading to inadvertent transfers, inadvertent chemical reactions, firefighting difficulties or hydrogen explosions	I33452	Externally Closed	08/14/1997
SAT-001	9720-5	Fire in wooden frame building resulting in spread of HEU contamination	I33444	Closed	10/03/1997
SAT-002	9720-5	Unverified inner container condition, presenting increased risk to workers	I33445	Closed	10/09/1997
SAT-001	9995	Fire caused by pyrophoric metals, flammable solvents, and gases in Analytical Laboratory	I33448	Closed	09/17/1997
SAT-002	9995	Unintentional chemical reactions caused by incompatible chemicals in Analytical Laboratory	I33449	Externally Closed	06/30/1997
SAT-001	Institutional	Lack of readily available information on HEU storage containers/material	I33465	Closed	10/09/1997
SAT-004	Institutional	Need for new radiological controls to ensure that worker exposures are minimized as HEU storage increases	I33469	Closed	08/19/1997
SAT-007	Institutional	Incomplete implementation of Y-12 Plant storage standards for some HEU materials	I33472	Externally Closed	08/12/1997

VAF Number	Facility	VAF Description	Internal Issue Number	Status	Closure Date
WGAT-006	Institutional	Insufficient maturity of Radiological Controls Program and lack of integration with operations, resulting in unnecessary worker exposures	I33480	Closed	08/19/1997
WGAT-007	Institutional	Personnel turnover and lack of training in the Emergency Response Organization, adversely affecting accident mitigation and response	I33481	Closed	04/17/1997
WGAT-008	Institutional	Deterioration of process equipment and lack of routine wipedown and decontamination, resulting in increased worker exposure	I33482	Externally Closed	08/11/1997
SAT-001	Multiple Facilities	Improper storage of HEU metal chips in water-based coolant, possible resulting in fire or explosion	I33456	Externally Closed	06/30/1997
SAT-006	Multiple Facilities	Release of HEU from unfiltered building ventilation or failure of Building 9212 wet vacuum system	I33463	Closed	07/07/1997
SAT-009	Multiple Facilities	Nuclear criticality program conduct of operation weaknesses	I33466	Externally Closed	06/30/1997
SAT-010	Multiple Facilities	Inability to hear criticality accident alarm system in normally unoccupied areas	I33468	Externally Closed	06/30/1997
WGAT-003	Multiple Facilities	Degradation of packaging and labeling, leading to contamination and worker exposure	I33451	Closed	07/18/1997
WGAT-005	Multiple Facilities	Storage of HEU solid and liquid materials in unsealed containers and lack of HEPA filters, leading to worker exposure	I33459	Externally Closed	08/14/1997
WGAT-006	Multiple Facilities	Increased fire potential from accumulation of temporarily stored, low-level radioactive combustibles	I33460	Closed	08/14/1997

Table A.2 - On-Hold HEU Vulnerabilities Action Plans

VAF Number	Facility	VAF Description	Issue Number	Status	Closure Date
SAT-002	Institutional	Training and qualification of Y-12 employees, noncompliant with DOE requirements	I33467	On-hold See roll up issue I31735	01/31/1999 (I31735)
SAT-006	Institutional	Decreasing experience levels for operating personnel	I33471	On-hold See roll up issue I31735	01/31/1999 (I31735)

Table A.3 – Open HEU Vulnerabilities Action Plans

VAF Number	Facility	VAF Description	Internal Issue Number	Major Activity Remaining	Closure Date
SAT-001	9204-2/2E	Fire caused by pyrophoric metal chips or loss of inert glovebox atmosphere	I33435	Submit SAR for facility.	01/31/1999
SAT-002	9204-4	Fire caused by pyrophoric material chips	I33436	Submit SAR for facility.	01/31/2000
SAT-001	9206	Incomplete fire protection by sprinklers for Buildings 9206 and 9720-17	I33437	Submit Basis of Operation (BIO) for facility.	06/29/1998
SAT-002	9206	Unintended chemical reactions/explosions, with spread of HEU	I33438	Submit BIO for facility.	06/29/1998
WGAT-002	9212	Releases due to failure of structural steel members and collapse of exterior wall during seismic and wind events	I33450	Submit SAR for facility. Complete physical upgrades to E-Wing.	10/30/2003
WGAT-001	9212/9206/ 9720-17	Extensive earthquake-caused HEU spills and exposures in Buildings 9212, 9206, and 9720-17	I33454	Submit SAR for facility.	01/31/2000
SAT-001	9215	Fire caused by metal chips, with HEU releases	I33443	Submit SAR for facility.	01/31/2000
SAT-001	9720-12	Fires caused or spread combustible materials stored in drums in Buildings 9720-12 and 9201-5	I33447	Submit BIO and SAR for 9720-12. Remove HEU from storage area in 9201-5 and consolidate in other areas.	10/30/1998
WGAT-003	9720-12	Potential wind and earthquake damage to sheet metal storage facility	I33455	Submit BIO and SAR for facility.	10/30/1998
SAT-001	CR9212	Fire in chemical recovery area with limited coverage by fire sprinkler systems	I33440	Submit SAR for facility.	01/31/2000
SAT-002	CR9212	Unintended chemical reactions/explosions, with spread of HEU	I33441	Submit SAR for facility.	01/31/2000

VAF Number	Facility	VAF Description	Internal Issue Number	Major Activity Remaining	Closure Date
SAT-003	EW9212	Potential fire in E-Wing filter house or metal chip fire, with HEU release	I33442	Submit SAR for facility. Replace filter bags in E-Wing baghouse with bags of fire retardant material.	01/31/2000
SAT-005	Institutional	Incomplete natural phenomena evaluation of Y-12 facilities	I33470	Submit BIO and SAR for 9720-12 and 9206. Submit SAR for remaining facilities.	01/31/2000
SAT-008	Institutional	Lack of storage standards for canned subassemblies and in-process material	I33473	Develop storage standards for CSAs and in-process materials. Note: In-process material standard development has been placed on-hold.	10/30/2001
SAT-009	Institutional	Incomplete implementation of Defense Board 94-4 recommendations (Conduct of Operations program weaknesses)	I33474	Implement requests for approval for Conduct of Operations in EUO, support and balance of plant organizations.	01/18/1998
SAT-010	Institutional	Facility and equipment maintenance hampered by large preventative maintenance backlog	I33475	Complete preventative maintenance program improvements.	01/31/1999
WGAT-001	Institutional	Failure of existing safety basis documents to identify all key barriers to accidents	I33476	Submit BIO and SAR for 9720-12 and 9206. Submit SAR for remaining facilities.	01/31/2000
WGAT-003	Institutional	Major Y-12 HEU storage areas noncompliant with DOE design criteria for fire, natural phenomena events and other events	I33478	Submit BIO and SAR for 9720-12 and 9206. Submit SAR for remaining facilities.	01/31/2000
WGAT-005	Institutional	Extended HEU storage due to lack of plan for stabilization of in-process HEU materials, jeopardizing workers, the public and the environment	I33479	Complete EUO restart and begin processing backlog.	05/30/1999

VAF Number	Facility	VAF Description	Internal Issue Number	Major Activity Remaining	Closure Date
SAT-002	Multiple Facilities	Intrusion of water into Y-12 processing or storage areas	I33457	Perform engineering assessments relating to deteriorating roofs as well as storm water run-offs. Note: actions have been placed on-hold pending funding.	10/30/1998
SAT-003	Multiple Facilities	Uranium contamination from past practices, presenting a low-level risk to workers and medium risk to the environment	I33458	Complete accelerated decontamination work.	No date assigned to issue, last action due 09/30/1999
SAT-005	Multiple Facilities	Potential leaks and spills from handling of process equipment and storage containers, which represent sources for HEU contamination of workers	I33461	Install additional continuous air monitors. Remove product cooler of the primary intermediate evaporator from process utilities.	05/01/1999
SAT-007	Multiple Facilities	Large backlog of HEU material awaiting processing and in-process materials containing HEU increasing the potential for HEU leaks/spills and releases during accidents.	I33464	Complete EUO restart and begin processing backlog.	05/30/1999
SAT-011	Multiple Facilities	Fire potential from leaks in methanol-water cooling system	I33487	Reduce methanol content to nonflammable concentrations.	11/27/1997
WGAT-001	Multiple Facilities	Lack of independent verification in the Y-12 lockout/tagout program, leading to worker contamination or injury	I33446	Implement requests for approval for conduct of operations.	01/18/1998
WGAT-004	Multiple Facilities	Storage of HEU containers on open racks, without restraints, leading to accidents and spills	I33453	Submit SAR for facilities.	01/31/2000
WGAT-007	Multiple Facilities	Inadequate lighting, increasing the potential worker accidents and injuries	I33462	Reevaluate areas to verify that adequate lighting has been maintained.	11/30/1997

Appendix B
Detailed Status Report on Potential PAAA Noncompliances

Table B.1 - Closed Potential PAAA Noncompliance Action Plans

NTS Number (ORPS Number)	Description	Internal Issues Number	Closure Date	Significance Level
NTS-ORO-LMES-Y12NUCLEAR-1996-0001 (ORO-LMES-Y12NUCLEAR-1996-0010)	Operational Safety Requirements (OSR) violation. Fire patrol not completed within time limits.	I30736	02/15/1997	Significant
NTS-ORO-LMES-Y12NUCLEAR-1996-0002 (ORO-LMES-Y12NUCLEAR-1996-0016)	OSR violation. Personnel violated Criticality Accident Alarm System (CAAS) compensatory measures.	I31254	11/07/1996	Significant
NTS-ORO-LMES-Y12NUCLEAR-1997-0001 (ORO-LMES-Y12NUCLEAR-1997-0006)	OSR violation. Personnel violated CAAS compensatory measures.	I33378	07/23/1997	Significant
N/A	Deficiencies in Issues Management Program	I30411	06/10/1997	Minor
N/A	Management assessment deficiencies	I30412	08/20/1997	Minor
N/A	Unreviewed Safety Question Determination deficiencies	I30654	10/24/1996	Minor
(ORO-LMES-Y12NUCLEAR-1996-0003)	Inadvertent access to radiation area. Area not correctly posted.	I30751	12/12/1996	Minor
(ORO-LMES-Y12NUCLEAR-1996-0013; ORO-LMES-Y12NUCLEAR-1996-0015)	Discovered combustibles in nonapproved areas.	I31261	03/20/1997	Minor
(ORO-LMES-Y12NUCLEAR-1996-0014)	Potential intake of radioactive materials by five employees	I32230	10/16/1997	Minor
(ORO-LMES-Y12NUCLEAR-1996-0022)	OSR violation during conduct of quarterly CAAS surveillances. Entered 15 foot boundary.	I32253	05/08/1997	Minor
(ORO-LMES-Y12NUCLEAR-1996-0021)	Potential concern/issues during conduct of work on master box. Limiting Condition of Operation (LCO) systems served by master box.	I32257	05/06/1997	Minor
(ORO-LMES-Y12NUCLEAR-1996-0019)	Attempt to remove material out of protected area.	I32258	10/30/1996	Minor
N/A	ES Technical Assessment Group finding on Radiological Protection Program implementation. Individual entered area without respirator. Two individuals signed wrong Radiological Work Permit (RWP). Three persons not on bioassay program as required.	I32442	10/16/1997	Minor

NTS Number (ORPS Number)	Description	Internal Issues Number	Closure Date	Significance Level
(ORO-LMES-Y12NUCLEAR-1996-0027)	OSR Violation. Fire patrols failed to enter area outside of Material Access Area.	I32993	06/18/1997	Minor
(ORO-LMES-Y12SITE-1996-0045)	Personnel Contamination	I32994	03/17/1997	Minor
(ORO-LMES-Y12NUCLEAR-1997-0011)	OSR Violation in Building 9204-4. Vacuum gauge left in fissile material work station.	I33546	06/02/1997	Minor
(ORO-LMES-Y12NUCLEAR-1997-0012)	OSR Violation in Building 9204-2. Empty shipping container uprighted without entering LCO.	I33547	06/02/1997	Minor
(ORO-LMES-Y12SITE-1996-0046)	Wood pallets found in Building 9204-4 in violation of authorization basis documents.	I33682	06/03/1997	Minor
N/A	Radiological Protection Program deficiencies - LMES-Wide (Bioassay, RWP Training)	I34210	10/01/1997	Minor
N/A	Personal Nuclear Accident Dosimters at Y-12 – Request for Exemption	I32763	09/11/1997	Minor

Table B.2 - Open Potential PAAA Noncompliance Action Plans

NTS Number	Description	Internal Issues Number	Scheduled Closure Date	Significance Level
NTS-ORO-LMES-Y12NUCLEAR-1997-0003 (multiple)	Potential Adverse Trend in CAAS. Since May 1996, 18 events have occurred related to the CAAS.	I34304	Plan under development	Significant
NTS-ORO-LMES-Y12NUCLEAR-1997-0002 (ORO-LMES-Y12NUCLEAR-1996-0026)	Unreviewed Safety Question in Building 9720-12. Inconsistencies between facility configuration and existing safety documentation.	I33612	05/30/1998	Significant
(ORO-LMES-Y12NUCLEAR-1996-0020)	Inadequate OSR Surveillance	I32252	01/31/1999	Minor
(ORO-LMES-Y12NUCLEAR-1997-0004)	OSR Violation in Modular Storage Vault. Corrected CSA noncompliance prior to entering LCO.	I33956	Plan under development	Minor

Appendix C
Detailed Status Report on Issues Management Action Plans

Table C.1 – Closed Issues Management Priority Issues Action Plans

Description	Internal Issues Number	Closure Date
Radiological Protection Postings	I32937	09/15/1997
Dikes	I27763	07/15/1997

Table C.2 – Open Issues Management Priority Issues Action Plans

Description	Internal Issues Number	Scheduled Closure Date
Configuration Management A plan has been submitted to DOE. The effectiveness of this plan needs to be monitored as implementation of the plan progresses.	I30302	09/01/1998
Document Control	I29557	04/19/1998
Facility Specific Emergency Planning Not all facilities have completed facility hazards assessments, facility-emergency planning, and self-assessments as required. Only a few additional examples of this issue were identified in the last year. However, the overall effectiveness of this plan needs to be monitored as implementation of the plan progresses.	I30357	01/30/2000
Fire Protection Program The Fire Protection Program has major programmatic weaknesses that need to be addressed. The current plan is 40 percent[2] complete and is behind schedule. The effectiveness of this plan needs to be monitored as implementation of the plan progresses. DOE has requested that the plan be revised to reflect the current projected completion date. Several subtrends have been identified. Plans are in place to address these concerns. Also see I31820 and I15113.	I30299	01/15/1998
Work Process Control Some ongoing work activities are not consistent with safe work practices nor conducted in accordance with established procedures. A plan was transmitted to DOE outlining initial actions needed to pilot a fix. A plan has been finalized for this issue. The effectiveness of this plan needs to be reviewed when implementation is complete.	I32908	10/30/1997

[2] Percentage of completion is as of March 1997**,** the issuance date of the Issues Management Report.

ENCLOSURE

The Y-12 Plant Year-End Status Report on the Response to the Secretarial Initiatives on Chemical and Radiological Vulnerabilities

Y/NS-0002/R1

December 5, 1997

Reference: Letter dated December 5, 1997; Subject, "DE-AC05-84OR21400, Secretarial Initiative on the Explosion at the Hanford Facility"

Y/NS-0002/R1

The Y-12 Plant Year-End Status Report on the Response to the Secretarial Initiatives on Chemical and Radiological Vulnerabilities

December 5, 1997

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LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC-05-84OR21400

The Y-12 Plant Year-End Status Report on the Response to the Secretarial Initiatives on Chemical and Radiological Vulnerabilities

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Prepared by the
Y-12 Plant
Oak Ridge, TN 37831-8235
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Abbreviations, Acronyms, and Initialisms

AB	Authorization Basis
ASO	Analytical Services Organization
BIO	Basis for Interim Operations
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EPCRA	Emergency Planning and Community Right-to-Know
EPA	Environmental Protection Agency
ESAMS	Energy Systems Action Management System
ESH	Environmental, Safety, and Health
ESH&QA	Environmental, Safety, Health and Quality Assurance
EUO	Enriched Uranium Operations
GET	General Employee Training
HAZCOM	Hazardous Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEU	Highly Enriched Uranium
HHC	Highly Hazardous Chemical
HMIS	Hazardous Materials Inventory System
ISMS	Integrated Safety Management System
LMES	Lockheed Martin Energy Systems, Inc.
MSDS	Material Safety Data Sheet
NARC	No Added Radioactive Contamination
NMCA	Nuclear Material Control and Accountability
NPDES	National Pollution Discharge Elimination System
ORPS	Occurrence Reporting and Processing System
OSB	Operational Safety Board
OSHA	Occupational Safety and Health Administration
PAAA	Price-Anderson Amendments Act
PCB	Polychlorinated biphenyl
PSM	Process Safety Management
PSS	Plant Shift Superintendent
ORR	Operational Readiness Review
RADCON	Radiological Control Organization
RCRA	Resource Conservation and Recovery Act
RMP	Risk Management Program
RU	Requirement Unit
SARA	Superfund Amendment and Authorization Act
SPE	Solid Phase Extraction
TIM	Training Implementation Matrix
TRU	Transuranics
TSCA	Toxic Substances Control Act
WETF	West End Treatment Facility
WITS	Waste Tracking System
WMO	Waste Management Organization
WWW	World Wide Web

Executive Summary

As a result of the explosion at the Hanford Plutonium Reclamation Facility on May 14, 1997, Secretary Federico Peña directed the Department of Energy (DOE) Operations Office Managers in an August 4, 1997, letter to implement several broad-based initiatives with the purpose of identifying and preventing similar situations. Four specific initiatives were identified in Secretary Peña's letter. The initiatives, which are the subject of this report, read as follows:

> Initiative 1 - *DOE site contractors must scrutinize their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release, and must promptly dispose of unneeded chemicals in accordance with safety requirements and environmental regulations.*
>
> Initiative 2 - *DOE field offices must reassess known vulnerabilities (chemical and radiological) at facilities that have been shut down or placed in standby mode and facilities in the process of being deactivated. Facility operators must evaluate their facilities and operations for new vulnerabilities on a continuing basis.*
>
> Initiative 3 - *DOE and contractor field organizations with operational responsibilities must assess the technical competence of their staffs to recognize the full range of hazards presented by the materials in their facilities, act on results, and implement training programs where needed.*
>
> Initiative 4 - *DOE field offices must assess their site Lessons Learned and Occurrence Reporting programs to assure that 1) outgoing information is well characterized and properly summarized, and 2) incoming information is thoroughly evaluated, properly disseminated, appropriately implemented, and tracked through formal management systems.*

Since the voluntary stand down of operations in September 1994, Y-12 operations have undergone numerous reviews by DOE Headquarters, DOE Oak Ridge Operations, Y-12 Site Office, and the Defense Board. Presently, all major mission areas with the exception of Enriched Uranium Operations (EUO) have undergone readiness assessments and been authorized to restart. EUO is undergoing a series of process-based Operational Readiness Reviews (ORR) which are scheduled to be completed in 1998 (Phase A) and 1999 (Phase B). EUO is presently allowed to conduct limited "special" operations. Actions taken for the readiness assessments and ORR have enhanced the discipline and rigor of the environmental, safety and health (ESH) programs at the Y-12 Plant. Plans have been established for those programs needing improvement.

This report presents a summary of Y-12 known vulnerabilities as identified in the designated DOE-led vulnerability studies and Defense Board reviews. A preliminary review of facility conditions was conducted earlier this summer in response to the Red Alert issued on May 28, 1997, for the Hanford explosion. This review did not identify any new vulnerabilities. Facility "walkdowns" intended to validate the earlier review have been completed. The facility managers were asked to examine their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release. Particular emphasis was placed on legacy chemicals and materials located in inactive facilities. Detailed instructions were developed for the conduct of these "walkdowns," including how Y-12 Facility Managers can identify time-dependent chemical hazards in the workplace as well as how to document the results. To date, no new major vulnerabilities have been identified.

Corrective actions are under way to eliminate or reduce the known vulnerabilities at the Y-12 Plant. Existing systems and processes are in place to prevent or resolve any future vulnerabilities that may arise. Training and qualification programs have been established which utilize a structured approach to training to ensure training requirements are identified and implemented based upon the hazards and complexity of operations in a job assignment. The Lessons Learned and Occurrence Reporting Programs identify and disseminate information on outside issues and events which could have analogies within the Y-12 Plant. Similarly, these programs report internal issues and events which could have analogies within the complex. Current funding constraints will influence the ability and pace of the Y-12 Plant to eliminate all vulnerabilities; however, Y-12 is committed to the principles of integrated safety management, providing a safe workplace, and performing work safely.

1. INTRODUCTION

1.1 Purpose of Report

In his August 4, 1997, letter on the explosion at the Hanford Plutonium Reclamation Facility, Secretary Peña requested the implementation of four broad-based initiatives to identify and prevent similar situations. These initiatives require the contractor to:

- Scrutinize their use, storage, and disposal of chemicals and waste
- Reassess known vulnerabilities
- Assess their technical competence to recognize hazards and resolve vulnerabilities
- Assess their Lessons Learned and Occurrence Reporting Programs to ensure information is understood and properly evaluated and implemented

This report provides a comprehensive response to these initiatives including a description of the Y-12 programs utilized to prevent or control chemical hazards which may arise during the course of work at the Y-12 Plant as well as an overview of known vulnerabilities and action plans for correcting these vulnerabilities. A discussion of the Y-12 Integrated Safety Management System (ISMS) is also included since this program will systematically integrate safety into management and work practices at all levels.

1.2 Site Description

The Y-12 Plant is one of two installations in Oak Ridge, Tennessee, managed by Lockheed Martin Energy Systems, Inc. It is located at the western end of the Bear Creek Valley. The Y-12 industrial complex is about .6 miles wide by 3.2 miles long and encompasses 811 acres. It is within the corporate limits of the city of Oak Ridge and is separated from the populated area by Pine Ridge. The Plant is located on a valley floor about 950 feet above sea level and is bounded on the northwest and southeast by parallel ridges that rise about 300 feet above the valley floor.

The Oak Ridge Y-12 Plant was built in 1943 as part of the Manhattan Project. The original mission of the Plant was to separate the fissile isotopes of uranium from natural uranium. This process was discontinued after World War II. The mission of the Y-12 Plant has evolved and changed over the years with the easing of international tensions and the resulting conclusion of the Y-12 Plant weapons component product mission in 1992. There are no high hazard facilities and only nine moderate hazard facilities located at the Y-12 site. Because of its changing mission, the number of these facilities may be further reduced in the future.

The Defense Programs missions of the Y-12 Plant include: (1) dismantling of nuclear weapons components returned from the national arsenal, (2) maintaining nuclear production capability and stockpile support, (3) serving as the nation's storehouse of special nuclear materials, and (4) providing special production support to DOE programs. Other missions include: (1) environmental restoration and waste management, (2) support of other federal agencies through a

Work for Others Program, (3) applying unique manufacturing expertise, initially developed for military purposes, to industry manufacturing problems through the Technology Transfer Program, (4) combining the Y-12 expertise in manufacturing technology with the research and development capabilities available at the Oak Ridge National Laboratory, (5) transferring manufacturing technology to the private sector, and (6) providing specific assistance on manufacturing problems directly to the private sector.

Hazards associated with the Y-12 site include: (1) exposure to low-level radiation or toxic materials, (2) exposure to hazardous material residuals from the previous missions, (3) deterioration of structures (some of which are 50 years old), (4) death or injury due to standard industrial activities (i.e., hoisting and rigging accidents, falls down stairs), (5) fire, and (6) natural phenomena hazards (e.g., tornado, floods, blizzards).

2. INTEGRATED SAFETY MANAGEMENT SYSTEMS (ISMS)

2.1 Overview of ISMS

On June 4, 1997, the Y-12 Plant submitted Y/AD-635, *Y-12 Integrated Safety Management System*, dated May 30, 1997, which described the methodology of the Y-12 ISMS. The Y-12 ISMS is a process to ensure that ESH objectives are achieved and the controls necessary to meet those objectives are in place, encompassing all facets of hazards assessment and subsequent planning and execution of work.

The activities and facilities at the Y-12 Plant are very diverse. Therefore, a tailored approach consistent with diverse operations and hazards is being utilized rather than a one-size-fits-all approach. The ISMS will be implemented in phases and tailored based on the hazards and risks associated with specific facilities and organizations. While Y/AD-635 broadly establishes the ISMS and its implementation from a sitewide perspective, it specifically describes a rigorous and formal system for implementation in highest risk facilities: Enriched Uranium Operations (EUO); Disassembly and Assembly; Quality Evaluation; and Receipt, Shipment, and Storage. The balance of plant organizations and facilities will implement the ISMS using a tailored approach, based on the hazards and risks associated with the work in their facilities.

The strategy for implementing ISMS focuses on modifying and reorganizing, as required, existing safety management programs and resources to perform work in a safer and more efficient manner while minimizing the increase in operating costs. Many ESH and work control programs that implement the safety management functions are institutionalized, work scopes are defined, hazards are analyzed, and controls are implemented to ensure work is performed safely. However, a comparison of the existing programs at the Y-12 Plant to the ISMS guiding principles identifies significant opportunities for improvement in the integration of these programs, as well as specific programmatic improvements necessary to strengthen ISMS. These improvements include strengthening the unreviewed safety question determination program, maintenance work control program, and authorization basis documentation.

2.2 Operational Work Control[1]

The key component of ISMS is the analysis of hazards and the development of appropriate work controls to control the hazards and perform the required operations. At the Y-12 Plant, operational work is defined as work performed by an operating organization. The scope of operational work includes hands-on work performed by Nuclear Operations organizations, EUO, and the Special Materials Organization, including activities such as assembly and disassembly of

[1] A separate process is used to control maintenance work. See Y/AD-635 for further information on maintenance work controls.

weapons components, manufacturing of components, and weapons quality assurance and evaluation activities.

Also included in operational work are activities such as operational checks, rounds, and surveillances. This "routine" work is authorized by the Operations Manager through the "Plan of the Day" meeting and is executed according to established procedures or checklists. The Conduct of Operations Manual institutionalized the disciplined manner in which work is performed. Pre-job briefs, approved procedures or work instructions, standard signs and postings, communication protocols, and training and qualification programs are some of the tools used to ensure that routine work is performed safely. Where required, based on the job hazard analysis, work permits identify personal protective equipment and other controls necessary to do the work.

The scope of operational work authorized for each facility was defined at the time of restart via the readiness assessment and falls within the facility's approved safety authorization basis. The process used to evaluate new operational activities and any changes in scope to an operational activity, is defined by Y-12 Plant Procedure Y10-190, *New Activity Start-up Requirements*. The Y10-190 process is applicable to any facility that has been restarted according to Y60-024, *Y-12 Readiness Assessment Process*, and for which a defined set of operational activities is authorized.[2]

The Y10-190 process ensures: (1) the appropriate level of review is performed so that work is performed within the facility's authorization basis, (2) if new hazard analysis requirements are identified, hazard analysis is conducted, (3) adequate safety controls will be in place before the work begins, (4) training/qualification requirements are identified and completed, and (5) certification at the appropriate level is conducted for the proposed new work activities.

2.3 Operational Safety Board (OSB)

Implementation of the Y-12 ISMS provides operation line managers with the technical resources and processes necessary to fulfill their responsibilities for managing their safety envelope. Through the assignment of key technical resources to the OSB, work planning is accomplished using a multi-disciplined team approach so that potential hazards are identified and analyzed and controls and integrated and implemented to protect the worker, public, and environment.

The role of the OSB is to support and advise the operations manager in work planning and authorization, oversight of work execution, maintenance of the facility safety envelope, and self-assessment and oversight of the safety management processes. The operations manager has ultimate responsibility for safety in the facility and, as such, maintains final decision making authority. Depending upon the nature of the activities under review, appropriate representatives

[2] The EUO facilities are currently being resumed using "Process Based Restart" and Y10-190 will be implemented within EUO following resumption completion.

from ESH disciplines, tenant organizations, and technical support staff may participate on the OSB. The OSB is an adaptation/extension of the Facility Configuration Control Boards that have been established to ensure facility changes are adequately analyzed and controlled.

2.4 Status of Implementation

The Y-12 ISMS has not been fully implemented at the Y-12 Plant. Improvements are necessary to some programs while others require modification/reorganizing to ensure effective and efficient integration is achieved. A draft Y-12 Plant procedure on ISMS has been issued for comment. This procedure will formally document the roles and responsibilities of plant personnel in the ISMS process including the OSB.

The following milestones have been established for the implementation of ISMS:

Activity	Scheduled Completion Date
Develop and issue program and business management process and associated procedure.	January 31, 1998
Complete Phase I implementation in Nuclear Operations and tenant/support organizations	January 31, 1998
Conduct self-assessment of Phase I implementation	March 1998
Establish Phase II implementation strategy for balance of plant	March 31, 1998
DOE verification review of Phase I implementation	Spring 1998

3. USE, STORAGE, AND DISPOSAL OF CHEMICALS AND WASTE

This chapter addresses the first initiative outlined in Secretary Peña's August 4, 1997, letter on the explosion at the Hanford Plutonium Reclamation Facility which requested:

> *DOE site contractors [to] scrutinize their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release, and must promptly dispose of unneeded chemicals in accordance with safety requirements and environmental regulations.*

3.1 Waste Storage and Disposal Program

3.1.1 System Overview

The safe handling, environmentally compliant storage, and disposal of hazardous chemicals and waste is conducted in accordance with a series of Lockheed Martin Energy Systems procedures, Y-12 Plant procedures, and Waste Management Organizational procedures. These procedures flow down from the requirements found in 40 CFR, Hazardous Waste Regulations, "Hazardous Waste Management" and 49 CFR, Transportation. Where site level requirements have been established that affect safe handling, environmentally compliant storage, and disposal of hazardous chemicals and waste, those requirements have been integrated into the procedures by which the Y-12 Waste Management Organization (WMO) conducts operations.

The process begins with the generator of the waste. In accordance with ES/WM-6, *Waste Certification Program Plan for Oak Ridge K-25 Site and the Oak Ridge Y-12 Plant*, the generator must recognize potentially hazardous wastes, fill out a "Request for Disposal" form and certify that waste complies with ES/WM-10, *Waste Acceptance Criteria for the Oak Ridge K-25 Site and the Oak Ridge Y-12 Plant*. The generator of the waste is responsible for the compliant packaging and segregation of the waste in accordance with Y-12 Plant Procedure Y70-903, *Y-12 Waste Management* Appendix C, "Packaging Requirements-General"; Appendix E, "Packaging Requirements for PCB Waste"; Appendix F, "Packaging Requirements for Radioactive Waste"; and/or Appendix G "Packaging Requirements for Hazardous Waste and Mixed Waste." If the waste is radioactive scrap metal, the generator must comply with Y70-309, *Radiologically Contaminated Scrap Metal*. After the waste has been segregated to avoid material incompatibilities and packaged, the generator must comply with Y70-310, *Waste Container Labeling*. Waste Management technicians will then inspect the waste, packaging, and labeling to confirm compliance and to prepare to receive the waste into inventory.

The Y-12 Waste Management Organization will then comply with Y70-303, *Control of Industrial and Construction/Demolition Wastes*; Y70-304, *Preparation of Hazardous Waste in Sealed, Unopened Containers for Off-site Shipment*; Y70-306, *Preparation of Hazardous Waste for Off-site Shipment: Based on Process Knowledge for No Added Radioactive Contamination (NARC) Certification*; or Y70-307, *Preparation of Hazardous Waste for Off-site Shipment*:

Based on Analytical Techniques for No Added Radioactive Contamination (NARC) Certification, as well as the facility and organizational procedures to handle, store, or dispose of the waste. Radiological Control Organization (RADCON) will survey the waste in accordance with Y70-101, *Transfer and Management of Material for Radiation Control*, to ensure compliance with the radioactive controls.

Waste generators and Waste Management personnel must also comply with Y70-905, *Control, Handling, and Disposal of Polychlorinated Biphenyls (PCBs)*; Y70-913, *Off-Site Transportation Safety; Y70-916, On-Site Transportation Safety*; and/or Y70-922, *Environmental Guidance for the Emission of Asbestos, Beryllium, and Uranium at the Y-12 Facility* to insure protection to the environment and the public.

3.1.2 Waste Tracking System

The Waste Tracking System (WITS) is a comprehensive, integrated, and flexible information system for the management of waste including legacy waste and waste information. WITS is targeted to be the consolidated Waste Information and Tracking System supporting the Environmental Management and Enrichment Facilities including the facilities operated by Y-12 WMO. The WITS is currently being deployed as a replacement for the existing waste tracking systems currently in production at the Y-12 Plant and the East Tennessee Technology Park in Oak Ridge. Upon deployment, WITS will be utilized by the Environmental Restoration organization in Oak Ridge to provide media and waste management information support and tracking.

The WITS is a model-driven application, which allows it more flexibility to meet a broader set of requirements than its predecessors, and tracks all types of waste (i.e. sanitary, low-level, RCRA, Mixed, transuranics (TRU)/TRU Mixed, aqueous, and spent nuclear fuel).

Waste management practices and information needs are constantly changing in response to evolving regulations and advancing technologies. Information is required throughout the waste management life cycle for a broad spectrum of business functions and activities, including:

Pollution prevention and waste minimization
Waste generation forecasting
Facility planning and management
Environmental restoration projects
Treatability studies
Processes that generate waste
Sampling and analysis
Decision Support.
Waste certification programs
Waste characterization
Waste repackaging
Waste movements
Off-Site shipments
Treatment, storage, and disposal
Regulatory compliance reporting

The WITS is a comprehensive system offering cradle-to-grave tracking of waste from waste planning and generation through final disposition and compliance reporting for a wide variety of waste types. Complete, accurate, up-to-date information may be collected for:

Low-level waste
RCRA mixed and Toxic Substances Control Act (TSCA) radioactive waste
TRU Waste and spent nuclear fuel
Liquid waste for specific treatment facilities
RCRA and TSCA regulated waste
Sanitary and industrial

3.1.3 Waste Management Facility Practices

3.1.3.1 Tanks

The Y-12 WMO maintains a database for waste storage tanks developed in response to the 1995 request of the Defense Nuclear Facilities Safety Board (DNFSB). The database specifically excludes polytanks, sumps, pits, trenches, water holes, cylinders, converters, compressed gas and liquid nitrogen containers, and containers with open tops and basins. As the custodian for the waste generated by Y-12, the WMO maintains an inventory of 39 active waste storage tanks and 15 inactive tanks all located within a diked area.

Active tanks are controlled by the WMO operations departments with strict operating procedures and defined waste acceptance criteria. Tank levels are checked continuously. Wastewater, process and sludge tanks are operated with an open top to prevent pressure build up. Flammable storage tanks are equipped with a foam fire-suppression system.

Inactive tanks are all reported to be empty or have some dried sludge at the bottom. Six of the inactive tanks have never been used to store any chemical or waste. Three other tanks and lines were taken out of service, flushed with water and emptied. The remaining six tanks were emptied during a consolidation effort. No vulnerabilities were identified.

3.1.3.2 Material Incompatibility Protection

The Y-12 WMO has a formalized system in place to evaluate all chemical purchases for in-process use which is part of the Hazardous Communication (HAZCOM) Program. For this initiative, chemical inventories were updated to reflect real-time inventory data for all facilities. These inventories will be entered into the Hazardous Materials Information System (HMIS) database. Evaluation of the inventories were performed to identify chemicals on-hand for which incompatibility and time-dependent hazard existed. No new vulnerabilities were identified.

Waste chemical handling, storage, disposal, and transportation are covered in the procedures listed above as well as mandated by permits for storage and treatment facilities. Wastes are

characterized by laboratory chemical analysis or by in-process work knowledge. Laboratory sampling provides an acceptable level of confidence that the chemical content and associated concentrations have been determined to facilitate the safe handling and storage compatibility. Control points are proceduralized which require persons completing this type of characterization to be qualified. By using process knowledge, this provides an acceptable degree of confidence in the results obtained. Upon receipt of waste containers from the generator, WMO facility operators evaluate the chemical hazards based upon the "Request for Disposal" shipping authorization document which must accompany each container of waste. Subsequently, the chemicals are stored or processed in accordance with proceduralized requirements.

For this initiative, the WMO performed a walkdown of every facility to verify that incompatible chemicals were being handled and stored in conformance with proceduralized requirements which ensure safety. Time dependent and shock-sensitive chemicals were also evaluated during this walkdown. No new vulnerabilities were identified.

3.1.3.3 Container Over Pressurization Protection

Over-pressurization of containers poses a constant hazard to Y-12 Waste Management, especially during the warmer temperatures of summer. In the operating procedure for every storage facility, there is a section on the proper procedure for handling and opening a container which may be over pressurized. Realizing the potential of possible injury to employees and wishing to emphasize the importance of the over-pressurized containers, the Y-12 WMO took additional steps to provide a safer atmosphere for those who have to work with drums.

Initially, efforts were made to replace all solid lid containers with a lid containing a pressure relief device. However, upon a failure of such a device, a Standing Order was placed into effect which provides all employees and supervisors with specific directions for opening any container. The Standing Order is as follows:

STANDING ORDER---OPENING DRUMS

CAUTION: For your personal protection always use proper personal protection equipment and CONSIDER ALL DRUMS, regardless of size, to be PRESSURIZED. Also remember the gas generated inside any drum could be flammable or toxic. When opening drums, always be in a well ventilated area, away from flame or spark sources, and use nonsparking tools.

Effective immediately, no solid lid drum shall be opened without the use of a drum lid restraining fixture or the tines of a forklift positioned over the drum without approval from the department manager responsible for the work, who is responsible for the safety and health of the employees assigned to that department. Listed below are the steps which are to be followed on all waste drums regardless of size or type. This Standing

Order is in place for all departments within the Y-12 Waste Management Organization.

1. When approaching any drum, look for signs of over pressurization such as bulging lids or bottoms, and be alert for escaping gas or vapors from sealed surfaces or holes. Work shall be discontinued if the employee is unsure of the situation or observes any sign of a potential problem.
2. Drums with signs of over-pressurization should not be moved, and no attempt should be made to open these drums until a safety study has been made of the particular situation and final approval is given by department supervision.
3. When opening all drums, employees shall work in pairs. Employees shall position themselves to the side of the drum, away from the lid or bung that could separate under rapid pressure.
4. When opening all flat top drums containing waste, the employee will position the tines of the fork lift closely over the drum lid before removing the locking ring being careful to avoid placing fingers between the tines and the lid.
5. When opening all drums containing waste with bung type lids, a soap solution shall be applied to the bungs or vent plugs before loosening. If bubbles are observed as the seal is broken, the bung should be left in place and the over-gas allowed to vent before the bung is fully removed.
6. Flat-top drums with pressure relief vent plugs in place may be opened by following either Step 4 or Step 5.
7. Operational records shall be kept to indicate how many drums were found over pressure along with their contents, and how each was dispositioned.

In addition to the Standing Order, the Y-12 WMO designed a fixture to attach the drum puncturing equipment to a fork lift to decrease the exposure of employees to a pressurized drum. A strapping device will soon be used on all drums which are to be opened. The strapping device is readily attached to the drum and allows a greater margin of safety to the operator opening drums without the need of a fork lift.

3.1.4 Facility Authorization Basis Program

A goal of the Y-12 WMO has been to conduct operations within facility authorization basis (AB) requirements. Specific actions that WMO has taken or will take to ensure compliance with facility AB documentation requirements include: (1) reviewing the categorization of each WMO facility; (2) assessing nuclear and radiological facilities through annual facility walkdowns; (3) identifying and assessing facility AB requirements and the procedures which implement them; (4) developing a self-assessment program to ensure continued safe and compliant operations;

(5) developing a configuration management program to ensure facility AB requirements are maintained and updated; and (6) establishing satellite command media "libraries" to ensure all workers have access to documents that dictate the specific operating, safety, health, and environmental requirements for their jobs. There are document centers for all command media (facility AB documents, health and safety documents, plans, operating procedures, etc.) that are used to support the operation of a WMO facility/process.

Facility AB document requirement unit (RU) checklists are being developed to assist department compliance engineers in assessing adherence. A new WMO computer Web page is currently in the last stages of completion. The page will include, among many other things, these RU checklists.

Another initiative that is currently under way is the preparation of facility AB documentation "fact sheets" and associated self-paced training study guides with accompanying questions that are applicable to each facility within the WMO. This material is subject to change, but currently each document is being reviewed for the following information that will go into the fact sheets: (1) purpose of the facility (what it does); (2) DOE Order 5481.1B hazard category; (3) DOE-EM-STD-1027-92 categorization; (4) the main accident scenario, where applicable, that resulted in the facility initial hazard categorization; (5) what, if any, permits are applicable to the facility; (6) what the waste acceptance criteria is for the facility; and (7) whether or not the facility is classified "radiological." All previously identified accident scenarios and hazards have been and are being rereviewed. This training is being developed to meet Y-12 Plant Unreviewed Safety Question Determination procedural requirements that are mandated for those personnel trained in the process; however, it will be given to all WMO personnel to complete. Current plans are to incorporate these facility fact sheets into the Web page development mentioned above.

3.1.5 Pollution Prevention

The Pollution Prevention Program promotes and implements practices that minimize the generation of waste by giving preference to source reduction, material substitution, and environmentally sound recycling over treatment, control, and disposal or release of such wastes. The overall objectives of the program are to foster a plantwide philosophy to conserve resources, reduce the costs of production operations, and create a minimum of waste and pollution in achieving site-strategic objectives through developing and implementing techniques, technologies, and programs that minimize waste and pollution generation. The Pollution Prevention Program promotes: (1) practices that reduce or eliminate the amount and toxicity of waste and pollutants in the air, water, and on land; (2) the use of nonhazardous materials in the Y-12 Plant operations to minimize the potential risks to human health and the environment; and (3) the elimination or reduction in the generation of waste materials through input substitution, product reformulation, process modification, improved housekeeping, on site closed-loop recycling, and off site recycling to achieve minimal adverse effects on the air, water, and land when technically and economically feasible and cost effective.

The Pollution Prevention Program has identified waste generating processes and is systematically performing Pollution Prevention Opportunity Assessments (PPOAs) to identify source reduction and recycling projects. Source reduction and recycling projects identified during PPOAs are tracked in a three-site database. The projects, which often concern chemicals, are updated on a quarterly basis until they are either canceled or completed.

Personnel at the Y-12 Plant have access to the three-site electronic Swap Shop, which is administrated by the Property and Materials Management Division. The Swap Shop allows chemicals that are declared excess by one division or site to be available to another division or site. The Pollution Prevention Program supports, promotes, and monitors Swap Shop activities and incorporates Y-12-related results into the Pollution Prevention Information Management System database on a quarterly basis.

Accomplishments

The following are examples of projects and activities that resulted in a reduction of waste, removal of excess chemicals, and reduction of vulnerabilities for CY 1997:

Digital imaging - The Information Management Services Division was encouraged to prepare a Pollution Prevention funding proposal to replace 25 percent of its traditional chemistry-based photographic process with digital photographic technology. This three-site Pollution Prevention project was awarded $38,589 of DOE-Headquarters (HQ) return-on-investment project funding.

Column waste reduction using automated solid phase extraction (SPE) system - The three-site high value return-on-investment team awarded the Analytical Services Organization (ASO) $74,297 of Pollution Prevention funding to purchase a Gilson ASPEC XL SPE System. This new equipment reduces by 50 percent acid waste from conditioning the columns used in the determination of radioisotopes in samples. The system delivers acid in low pressures to the columns, resulting in more efficient use of acid and less exposure to workers.

Substitute non-RCRA oil for RCRA oil - This reduces waste handling and regulatory problems, reduces cost, and makes the waste oil easier for disposal by Y-12 and DOE. This is part of an organizationwide effort to reduce oil use/toxicity.

Freon elimination - Freon has been used to dewater and clean enriched uranium chips prior to recycle. Regulations concerning ozone depleting chemicals make the use of Freon unattractive. Other fluorinated solvents are under investigation as a replacement for Freon.

Aluminum nitrate - Replaced the existing hydraulically driven centrifuges in Building 9818 with electrically driven units. Raffinate from primary extraction contains aluminum

nitrate which is added to facilitate extraction of uranium. Before the raffinate is disposed of as biosludge, the aluminum nitrate is removed from the waste and reused instead of preparing additional aluminum nitrate. The previous hydraulically driven centrifuges were very unreliable and required constant maintenance. It forced the West End Treatment Facility (WEFT) to remove and dispose of the aluminum nitrate as waste instead of recycling the material. This operation subsequently generated 4 to 5 times the sludge that the would be generated if the aluminum nitrate were removed. In addition, the electrically driven centrifuges eliminates the disposal of approximately 200 gallons per year of waste hydraulic oil.

Procurement of a silver recovery system - A silver recovery system was procured to recover the silver from the photographic waste being generated from the Y-12 Plant photographic applications. Currently, the silver bearing waste is required to be managed/disposed as a RCRA waste due to the silver component. With the purchase of the recovery system, the silver can be collected for recycle and the resulting waste stream would become a sanitary waste.

Paint waste - The installation of a Lenan Corporation Model SR80 solvent recovery unit at the MK-Ferguson Paint Shop has reduced the amount of waste generated from this operation. The unit recycles approximately 90 percent of the paint thinner placed in the unit for processing. The savings generated from the recycling effort is over $90,000 per year based upon a projected paint shop usage of 1,000 gallons of thinner.

ASO waste reduction - ASO individually separates neptunium and thorium from other radioisotopes. Prior practices/procedures generated 546 mL of RCRA waste per sample, 150 mL of that waste was nitric/methanol mixture. By taking advantage of new chromatographic resins that are now available, ASO developed a new procedure which allows ASO to separate Np and Th sequentially on one column; thereby, reducing the RCRA waste to 90 mL per sample. The nitric/methanol waste stream was completely eliminated, while the acid waste was reduced 46 percent.

Excess acid reuse - Reuse of excess acids from the Y-12 Steam Plant to be used for Bio-denitrofication at the West Tank Farm. Waste would have been declared a RCRA waste.

Recycle of wastes from Building 9720-31 - As part of Waste Shipping and Storage Operations' effort to remove waste from inventory when possible, approximately 66 pounds of mercury were reused as virgin material by Building 9201-4 personnel. This activity will remove waste from the Material Waste Inventory Report and avoided treatment/disposal under the site treatment plan.

Basin water - The S-3 basins fill with water from several sources: (1) West End Treatment Facility (WETF); (2) rain; and (3) well drilling. In past years, this water was routed to the tanks in Tank Farm 1 and the entire West End Treatment Facility/West Tank

Farm (WETF/WTF) process consuming valuable tank capacity, operator time, and chemical costs. Waste Treatment Operations personnel found a way to process the accumulated basin water through the WETF Effluent Polishing System (EPS), bypassing WTF completely. This water was successfully treated and discharged with little or no chemical costs. An additional improvement, which has been implemented, is to segregate the WETF water from other accumulated waters due to its F-listing. This will decrease the amount of water managed as hazardous waste in the future.

Dirty transformer oil can be filtered/dried instead of being disposed of as waste using portable equipment - Approximately 1500 gallons of transformer oil is disposed of each year. Dirty oil is the cause of most transformer failures. Monitoring is conducted to find best the candidate for filtering/drying.

Reuse of excess chemicals/materials from the Special Materials Organization - These chemicals/materials were taken by the Development Organization for use. These chemicals/materials would have been declared as waste and some may have been declared as RCRA waste.

Soygold - Disassembly and Storage Organization (DSO) is currently pilot testing a product known as "Soygold." This product is made from soybeans and is nonhazardous upon disposal. DSO is testing the product to determine if the product performs as well as the products that are currently being used within DSO. If the Soygold works as well as the other products, it will be used rather than the current products that potentially may produce a hazardous waste.

3.1.6 Other Potential Vulnerabilities Analyzed as Part of this Initiative

The Y-12 WMO was asked to comment on the following additional potential vulnerabilities which have been previously identified at other sites:

Potential Vulnerability 1: Waste Characterization data and packaging for certain legacy waste streams may not be adequate to access material compatibility.

The incompatibility of material in labpacks was looked at as part of our walkdown effort for the Peña initiative and no new vulnerabilities were identified. It will be studied again as part of the Y-12 Plant response to the action plan developed by the five-site committee formed as a result of the Paducah incident. Although, the Y-12 Plant has some labpacks in storage, the contents are known and understood with compatibilities verified before packaging.

Potential Vulnerability 2: Compatibility of containers for certain waste streams has not been proven.

The incompatibility of containers used in labpacks was looked at as part of the WMO walkdown effort for the Peña initiative and no new vulnerabilities were identified. It will be studied again

as part of the Y-12 Plant response to the action plan developed by the five-site committee formed as a result of the Paducah incident.

Potential Vulnerability 3: Long-term storage of waste could result in unanticipated vulnerabilities caused by container aging, chemical aging, and decomposition to unknown byproducts.

A database search was run on the Waste Tracking System to match the materials which tended to form peroxides during storage. Nine of the chemicals on the list were found in our inventory. Quantities were noted, and location of storage was verified. No new vulnerabilities identified.

Potential Vulnerability 4: Wastes are stored in facilities not designed for that purpose.

This is not a vulnerability at Y-12.

Potential Vulnerability 5: Known storage of incompatible wastes.

Based on the walkdowns, there are no known incompatible wastes stored that present a vulnerability.

3.2 Hazardous Materials Management Program

3.2.1 System Overview

The Y-12 Plant Hazardous Materials Management Program is founded on a basic ESH administrative strategy of applying: (1) procedures and standards, (2) information management systems, and (3) highly qualified people, to safely and effectively carry out the challenging tasks at a hazardous materials worksite. As implemented, the program embodies the basic concepts of integrated safety management contained in DOE Policy 450.4, *Safety Management System Policy*. (Section 2.0 provides an overview of the Y-12 ISMS).

Several Lockheed Martin Energy Systems (LMES) programs are directed to the thorough analysis of the presence and magnitude of hazards associated with chemicals: application of the Process Safety Management (29 CFR 1910.119) and Risk Management Program (40 CFR 68) requirements, the Safety Analysis Program (implementation of DOE Orders 5480.21, 5480.22, and 5480.23); the TOMSK Lessons Learned Program; Safety and Health Hazard Assessment Program (SHOI-214); Safe Work Controls Program (see Energy Systems Program Description SH-120PD); Hazardous Chemicals in Laboratories Program (SH-132PD); Personal Protective Equipment Program (SH-116PD); Safety and Health Incident Reporting and Accident Investigations (SH-170PD); and Compressed Gases Program (SH-176INS).

These programs and procedures require that chemical hazard analyses are conducted throughout LMES through methods such as initial hazard screening; process hazard analysis; hazard assessments (inspections and air sampling) conducted by safety and health professionals; routine

inspections conducted by line management and employees; job hazard analyses; safety work permits; safety and health plans; programmatic self-assessments; accident and incident investigations; and trend analysis.

3.2.2 Hazardous Material Tracking

Hazardous Material Inventory System (HMIS) is an Oak Ridge Reservation-wide electronic tracking and control system for hazardous chemical inventory that supports the ESH regulatory and management needs of Energy System. The system contains more than 100,000 hazardous material items and processes more that 2000 transactions per month. It also interfaces with the company's procurement systems to record purchase activity, material location, volume/weight amounts, and basic regulatory reporting information. HMIS uses Material Safety Data Sheets (MSDS) health, safety, and hazard information to associate hazardous items with control lists and to provide internal reports of regulated and controlled materials (e.g., carcinogens, reproductive toxins, Environmental Protection Agency [EPA] Extremely Hazardous Substances, Ozone Depleting Substances, Toxic Substances Control Act-listed materials, and Emergency Planning and Community Right-to-Know Act [EPCRA] 313 chemicals). It automatically generates supporting documentation for the EPCRA 312 chemical inventory report and for other recurring reports and special requests. HMIS provides the option for users to flag excess material and to browse the Excess Material List to identify materials available for reuse. Additional HMIS features are included in the following modules:

HMIS/Procurement Interface Module – allows an up-front hazard evaluation of all material requisitions prior to purchase; ensures that all hazardous materials are properly identified, and that MSDSs are readily available. Pollution prevention, waste minimization, or hazard reduction by substitution of less hazardous materials may also be considered and applied prior to a hazardous material being brought on-site.

Hazardous Materials Inventory Module – provides the ability to track and maintain chemical inventory information needed for regulatory compliance reporting under the EPCRA, originally designated by the EPA as the Superfund Amendment and Reauthorization Act (SARA).

HMIS Report Module – generates various reports interactively upon request of HMIS-trained users of the system; this module provides chemical custodians with an inventory tracking capability, as well a source of information about chemical purchases and use. The EPCRA compliance manager uses this module to monitor sitewide inventory totals for each chemical that could be reportable.

System Manager Module – allows system managers to monitor system activity; maintain error reports, lists, tables, and codes; manage access to the system; and perform quality assurance.

A focused HMIS assessment was conducted by the LMES Quality Director's Office in October 1997 in divisions where HMIS implementation is complete. The team found that the system is effective and in compliance with hazardous materials identification and tracking requirements. Field assessments verified that the HMIS database accurately reflected the actual chemical inventory.

3.2.3 Hazard Communication

The Energy Systems Hazard Communication Program Description, SH-140PD, outlines the methods for communicating the potential hazards of chemicals used in the workplace to workers. These methods include employee training, container labeling, and use of MSDS.

Awareness level hazard communication training is provided for all Energy Systems employees, service subcontractors, and visitors during General Employee Training (GET). Additional hazard communication training (Hazard Communication Level I) is provided based upon the potential for exposure to hazardous chemicals. Work area (job-specific) hazard communication training is provided by the responsible supervisor upon the employee's initial entry into the work area and whenever a new hazard is introduced into the work area. Labeling is used to identify hazardous chemicals and associated hazards.

MSDS for hazardous chemicals used in work areas must be accessible to employees, service subcontractors, and visitors. The MSDS provides detailed hazard information such as material compatibility data for chemicals purchased from the manufacturer and chemicals produced as byproducts or manufactured in the workplace. The responsible supervisor of each work area shall develop a list of the hazardous chemicals used in the work area. This list and corresponding MSDSs shall be readily available to workers for review.

3.2.4 Process Safety Management/Risk Management Program

In January and April of 1997, LMES reassessed its inventories of highly hazardous chemicals (HHCs) and flammable materials relative to the Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) Rule, 29 CFR 1910.119, and the EPA Risk Management Plan (RMP) Rule, 40 CFR 68. The results of the surveys indicated that one process at the Y-12 Plant presently exceeds the RMP threshold quantity for hydrochloric acid (HCl). If current inventories of HCl are maintained, a RMP will be required by June 21, 1999, to remain in compliance with 40 CFR 68. The Anhydrous Hydrogen Fluoride Supply System, which is presently not in operation and has no HHC inventory, was identified as a facility that may be covered by both rules when placed in operation. Should this be the case, Y-12 management fully intends to meet regulatory requirements before introduction of the HHC.

3.2.5 Laboratory Practices - Analytical Services Organization (ASO)

The ASO has policies and programs in place for safe handling of hazardous material, for the safe and compliant storage of those materials, and for safe and compliant disposal of hazardous chemicals and waste. As an analytical laboratory, ASO is required to operate under the requirements of 29 CFR 1910.1450, the OSHA Occupational Exposure to Hazardous Chemicals in Laboratories. ASO has a comprehensive Chemical Hygiene Plan, ASO-AP-0002, which is implemented at all facilities operated by ASO, including the ASO off-site laboratory. The ASO Chemical Hygiene Plan meets the requirements of the performance-based OSHA standard. The ASO Chemical Hygiene Plan: (1) identifies engineering controls and equipment, personal protective equipment, procedures, and work practices that are capable of protecting employees from anticipated and potential health hazards presented by hazardous chemicals used in the workplace; (2) defines chemical hygiene responsibilities for management and all ASO personnel; (3) identifies provisions for additional hazard evaluation to ensure adequate protection for personnel when working with particularly hazardous substances.

The ASO maintains an inventory of its chemicals. Before a chemical is ordered, information on proper handling, storage, disposal must be known. Before new chemicals are used in the laboratory, a manufacturer's MSDS is obtained and is available to personnel through the LMES electronic MSDS system. If a chemical presents a hazard not already found in the laboratory, appropriate training is conducted. Labels on incoming hazardous materials are not removed or defaced. Laboratory rooms are posted with "Designated Area" signs to focus attention on the hazards of the chemicals used and stored in the room.

The ASO has specified in its standard operating procedure ASO-AP-0007, *Analytical Services Organization Procedures*, that the hazards unique to the analytical operation must be included in the "Hazards" section of the analytical procedure. In addition to referencing the ASO Chemical Hygiene Plan, the "Hazards" section must mention specific cautions for hazards unique to the given procedure, such as electrical shock, acid splash, or generation of hazardous gases or fumes requiring operation in a hood. To ensure that incompatible wastes are not mixed together, specific cautions and instructions for the management, treatment (if applicable), and disposal of waste must be given in the procedure or an Area-Specific Waste Disposal Guide referenced in the procedure.

The ASO Chemical Hygiene Plan addresses chemical compatibility and storage in Section 6.6 of the procedure. The safe storage of chemicals is important within the laboratory to prevent or minimize accidental breakage, reactions, fire, or releases to the environment. The ASO chemical storage policy is based on the J. T. Baker, Inc., color-coding system. The J. T. Baker system segregates corrosive acids and bases as well as reactives, flammables, and chemicals with health hazards. The system is designed for laboratory application and was initially implemented in Y-12 ASO in 1993. With the consolidation of ASO, full implementation was required throughout the organization in April 1997.

The ASO evaluates hazardous properties of chemicals, including potential for change over time (e.g., shelf life, expiration date) both from a quality and safety perspective. The ASO procedure

ASO-SOP-0024, I*dentification and Control of Chemicals and Equipment*, lists specific requirements for shelf life of chemicals. Lacking guidance from the manufacturer, the shelf life/expiration requirements in ASO-SOP-0024 are used. Evaluation and documentation is required for the extension of shelf-life/expiration dates. In addition, the ASO Chemical Hygiene Plan (ASO-AP-0002) lists requirements for shelf life and testing of peroxidizables.

Section 5.3 of the ASO Chemical Hygiene Plan addresses requirements for materials with special hazards. Included in the list of materials that require special handling procedures are explosives, pyrophorics, and peroxidizables. In compliance with Energy Systems Instruction SH-118INS, *Job Hazard Analyses*, ASO supervisors are responsible for assembling teams to conduct analyses for: (1) jobs in which workers have expressed safety and health concerns, (2) routine work where the hazards and preventive measures have not been incorporated into an approved procedure or the hazards have changed thereby warranting reanalysis, (3) nonroutine work in which there are known or potential hazards, (4) new activities that could pose a known or potential hazard, and (5) jobs with high illness/injury rates or near misses. The job hazard analysis teams are comprised of ASO personnel involved in the work, supervision, ASO's analytical subject matter experts, and ASO's safety and health professionals.

Chemical and safety controls for in-process materials are defined in the analytical technical procedures. Revised or newly written procedures receive comprehensive review for technical accuracy and safety, health, and waste issues by ASO peers, management, and health and safety staff. The ASO has procedures for waste certification, Resource Conservation and Recovery Act (RCRA) waste, and polychlorinated biphenyl (PCB) waste management; analytical procedures with specific waste disposal requirements; and Area-Specific Waste Disposal Guides. Chemical hygiene, safety, and waste management in ASO are periodically assessed. These assessments include, but are not limited to, chemical storage practices, labeling of in-process chemicals, and waste handling issues.

3.3 Facility Safety Program

The Y-12 Facility Safety Department provides policy, guidance, oversight, and program development to the Y-12 Plant in areas of safety analysis in order to facilitate and enhance compliance with applicable DOE orders and federal regulations. It assists in ensuring the safety and health of workers and the public as well as the protection of facilities, equipment, and the environment.

Major duties and responsibilities of the Facility Safety Department include interface with the DOE, the Oak Ridge Operations Facility Safety Branch, and the Y-12 Site Office Health and Safety Branch. Personnel provide assistance to line organizations in the implementation of a phased/graded approach to updating safety analysis reports and other authorization basis documents such as unreviewed safety question determinations. Subject-matter experts provide technical review of authorization basis (AB) documents, interpretation of key program requirements, and assistance in the preparation of AB documents, unreviewed safety question

determinations, and in the general evaluation of planned modifications to hazardous facilities. Development of command media for the Facility Safety Program is a key responsibility. Additionally, the organization participates in safety readiness reviews and assists operating organizations in establishing criteria and documentation of compliance required for implementation and maintenance of safe operating envelopes.

The primary sources of requirements for the Facility Safety Program include DOE Orders 5480.21, 5480.22, and 5480.23 in addition to the requirements of 29 CFR 1910.119 and 40 CFR 68.

3.4 Facility Assessments and Walkdowns

In addition to reviewing known vulnerabilities identified in previous assessments, organizations at the Y-12 Plant were asked to conduct a series of walkdowns and facility assessments. The purpose of these assessments/walkdowns was two fold: (1) verify that existing management systems involving hazardous materials and waste are being implemented and (2) identify any vulnerabilities that may not have been previously identified.

3.4.1 Methodology

The following general instructions were provided to all organizations that use or store hazardous chemicals at Y-12:

1. Complete the HMIS baselines and updates.

2. Identify on the **Excess and Residual Chemical/Material Summary** form, any "residual" chemicals or materials in process piping, tanks, ventilation ducts, etc. This effort should focus on inactive facilities and systems.

3. WHEREVER chemicals (whether residual, unlisted, in HMIS, or in generator waste storage areas) are located, check for potential chemical incompatibilities using chemical compatibility charts and other guidance. Complete the **Material Incompatibility Summary** form for all areas assessed, including those areas where no incompatibilities were found.

4. Inventory gas cylinders and document on form provided. The purpose of this inventory was to motivate users to physically examine gas cylinders to: (1) determine if there were any safety concerns, (2) provide immediate corrections, or (3) if there was no further use for the material, initiate return to the vendor for appropriate disposal. The cylinder inventory provides only a snapshot in time due to various uses and dispositions of cylinders.

A copy of the instructions, Y/AD-637, "*Chemical Storage Hazards Identification*," is provided in Appendix A to this report.

3.4.2 Results

This section summarizes general results from the assessment/walkdowns. Detailed information is available upon request in the form of the individual organization response forms.[3] Based on the information gathered from the walkdowns and facility inventories, no new vulnerabilities were identified. In addition, the WMO was asked to review their operations to determine whether any of five specific potential vulnerabilities existed. The results of this review are documented in Section 3.1.6.

3.4.2.1 Sitewide Issues

Excess Chemicals

Numerous hazardous and potentially hazardous chemicals are located on the Y-12 site, many of which can potentially be declared excess. Appropriate engineering and administrative controls have been implemented to prevent or mitigate the consequences of potential accidents involving these chemicals. No decision will be made regarding declaration of excess chemicals for the Y-12 Plant until EUO operations has been restarted and an evaluation made.

HMIS

Prior to the incident at Hanford, efforts were underway to complete implementation of HMIS. Since HMIS has not been fully implemented, the system did not fully reflect the actual quantity of chemicals on site. The information developed during these walkdowns will be used to update HMIS and complete implementation of the system. Data entry is scheduled to be completed during the first quarter of CY1998.

Residual Chemical/Material Survey

Based on a preliminary assessment of the inventory, there were no significant quantities of residuals listed that might present a safety and health hazard. Where incompatible storage was identified during the walkdowns, small quantities were involved and the storage problem was corrected when found.

Material Incompatibility Summary

[3] Data entry into HMIS for the information contained on these forms is scheduled to be completed in the first quarter of CY1998. At that time, comprehensive reports can be made available.

No significant chemical incompatibilities were identified during the facility walkdowns. It is common to have small amounts of incompatible chemicals in a single storage area, as long as they are properly separated and secondary containment is ensured.

Gas Cylinder Inventory and Assessment

Numerous compressed gas cylinders on site do not have a documented use within the short term. Efforts are under way to develop a cylinder roundup plan to dispose of excess cylinders.

3.4.2.2 Organization Issues

The following organizations have completed their walkdowns and identified no additional issues or vulnerabilities beyond those outlined in Sections 3.4.2.1 and 4:

Organization	Major Facilities
Analytical Services Organization	9995, Union Valley
Business Management	9704-2
Development	9202/9203
Depleted Uranium Operations	9998, 9215, 9201-5, 9201-5W, 9201-5N, 9204-4, 9204-2, 9204-2E
Disassembly and Storage Organization	9204-2, 9204-2E, 9204-4, 9720-5
Enriched Uranium Operations	9212, 9206, 9215
Environmental Compliance	9769
Facilities Management Organization	Plantwide
General Manufacturing	9201-1, 9737
Health Services	9706-2
Human Resources	9711-5
Information Management	9766, 9731, 9739
Information Technology Services	9103
Nuclear Criticality Safety	9110
Product Certification	9201-1, 9204-2E
Quality Services	9201-1
RADCON	9711-1
Special Materials	9204-2, 9204-4, 9201-5E, 9201-5

Organization	Major Facilities
Waste Management	9720-28, 9404-7, Central Waste Storage Area, 9720-25, 9811-1, OD-9, OD-10

3.5 Waste Storage Tanks And Ancillary Equipment Assessment

3.5.1 Waste Management Organization

An assessment of waste storage tanks was conducted by the WMO assessment team in conjunction with field personnel, management walkdowns, and evaluation of real time inventories as part of the request by F. P. Gustavson for all Y-12 Plant facilities. The Y-12 WMO maintains a database for waste storage tanks developed in response to the 1995 request of the DNFSB. The database specifically excludes polytanks, sumps, pits, trenches, water holes, cylinders, converters, compressed gas and liquid nitrogen containers, and containers with open tops and basins. As the custodian for the waste generated by the Y-12 Plant, the WMO maintains an inventory of 39 active waste storage tanks and 15 inactive tanks.

Active tanks are controlled by the WMO operations departments with strict operating procedures and defined waste acceptance criteria. Wastewater, process, and sludge tanks are operated with an open top to prevent pressure build up. Flammable storage tanks are equipped with a foam-fire suppression system. No vulnerabilities were identified by the assessment team or the owners/operators of the active tanks.

Of the inactive tanks, all were evaluated individually and were reported to be empty or have some dried sludge at the bottom. Six of the inactive tanks have never been used to store any chemical or waste. Three other tanks and lines were taken out of service, flushed with water, and emptied. The remaining six tanks were emptied during a consolidation effort. No vulnerabilities were identified.

Federal, state, and local laws and regulations including National Pollution Discharge Elimination System and RCRA permits have been incorporated in the Y-12 WMO operating procedures to provide assurance of safe operation in the processing, storage, and discharge of waste.

3.5.2 Other Organizations

The WMO is the primary user of waste tanks at the Y-12 Plant. The remaining organizations control a small number of active waste storage tanks. Since these are active waste storage tanks, they are under strict programmatic controls to prevent incompatible materials from being introduced into the same tank and to aid in the characterization and final disposal of the material.

4. ASSESSMENT OF KNOWN VULNERABILITIES AT THE Y-12 PLANT

This chapter addresses the second initiative outlined in Secretary Peña's August 4, 1997, letter on the explosion at the Hanford Plutonium Reclamation Facility which requested:

> *DOE field offices must reassess known vulnerabilities (chemical and radiological) at facilities that have been shut down or placed in standby mode and facilities in the process of being deactivated. Facility operators must evaluate their facilities and operations for new vulnerabilities on a continuing basis.*

4.1 Status of Known Vulnerabilities

On October 31, 1997, Y/NS-0001/R0, "*Preliminary Reassessment of Known Vulnerabilities at the Y-12 Plant,*" was submitted to address the issue of known vulnerabilities in Initiative 2. Y/NS-0001 presents a summary of known vulnerabilities at the Y-12 Plant as identified in the designated DOE-led vulnerability studies and Defense Board reviews. A preliminary review of facility conditions was conducted earlier this summer in response to the Red Alert issued on May 28, 1997, for the Hanford explosion. This review did not identify any new vulnerabilities. Facility "walkdowns" intended to validate the earlier review have been completed. The facility managers were asked to examine their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release. Particular emphasis was placed on legacy chemicals and materials located in inactive facilities. Detailed instructions were developed for the conduct of these "walkdowns," including how Y-12 Facility Managers can identify time-dependent chemical hazards in the workplace as well as how to document the results. Since the submittal of that report, the facility walkdowns have been completed. Results of those assessments are included in Section 3.4. A copy of Y/NS-0001/R1 is included in Appendix B.

As identified in Y/NS-0001, corrective actions are under way to eliminate or reduce the known vulnerabilities at the Y-12 Plant. Existing systems and processes are in place to prevent or resolve any future vulnerabilities that may arise including, as needed, the development of compensatory measures. Funding will influence the ability and pace of the Y-12 Plant to eliminate all vulnerabilities; however, Y-12 is committed to the principles of integrated safety management to provide a safe workplace and perform work safely.

4.2 Process for Evaluating New Vulnerabilities

The systems used at the Y-12 Plant to identify and evaluate new vulnerabilities on an ongoing basis are consistent with the functions of ISMS. The overall site program for ISMS is described in Section 2.0. An important part of the site's ISMS program is the Y10-190 and work planning processes where hazards and vulnerabilities are identified and appropriate work controls put in place. In addition, the detailed programs, practices, and systems discussed in Sections 3.1 through 3.3 also assist in the prevention, identification, and control of vulnerabilities. The following

section provides an overview of the feedback and continuous improvement mechanisms which are also used to assist in the prevention, identification, and control of vulnerabilities.

4.2.1 Sitewide Programs

Radiological Control Surveys and Assessments

Radioactive contamination surveys are performed in certain areas on a routine basis, and in other areas as requested to support projects and work activities. Surveys are also performed if radioactive contamination is suspected to be present in areas where contamination was not previously known to be present. The RADCON surveys are limited to radiation and radioactive contamination. Self-assessments are performed on a daily, weekly, and quarterly basis as prescribed by procedure RCO-AD-400. Results are documented on Radiological Deficiency Reports, Management by Walking Around Reports, and Surveillance Reports.

Annual LMES Integrated Audits

LMES performs annual integrated audits, which consist of subteams addressing management and quality, safety and health, and environmental protection issues. The audit subteams are made up of subject matter experts from other LMES sites and central staff who perform an in-depth review of processes and field conditions with an emphasis on safety, health, and environmental protection. Audit findings, including those that identify vulnerabilities, are addressed through the issues management process.

Corporate Environment, Safety, Health, and Quality Assurance (ESH&QA) Audits

Every three years, a Lockheed Martin Corporation ESH & QA audit is performed by a team of subject matter experts from other sites across the country. These audits emphasize safety, health, and environmental protection in the work place and compliance with related regulations and orders. Audit findings, including those that identify vulnerabilities, are addressed in corrective action plans approved by senior Lockheed Martin management.

Annual Environmental Self-Assessments

A self-assessment of the Y-12 Plant is performed by the Environmental Compliance organization annually. Included in the self-assessment are activities conducted throughout the year, such as:

- RCRA satellite and 90-day accumulation area assessments
- PCB storage areas assessments
- Clean Air Act assessments
- Clean Water Act assessments

Internal Independent Audits

A series of audits of site activities, including those related to vulnerability identification and correction are performed each year, independent of the management self-assessments. The audits are performed by trained auditors, using checklists based on regulations and requirements. As with other audits, the findings are placed in the issues management system and tracked until corrected

Fire Protection Evaluations and Audits

The Y-12 Plant Fire Protection Engineering Department prepares engineering assessments of most major buildings on the site. These assessments involve walkdowns of the building by a qualified fire protection engineer, analysis of the building for compliance with relevant fire codes and standards, and preparation of a report that includes building description, building occupancy, life safety considerations, fire risk analysis, findings, and recommendations.

The Fire Department staff performs routine walkdowns of in-use buildings at the Y-12 Plant. The walkdowns identify dangerous accumulations of combustibles, blocked exits, and impaired or missing fire-related equipment.

Line/Facility Self-Assessment

Line management has the primary responsibility for implementing an effective, ongoing self-assessment program that ensures participation by their employees as well as all levels of management within their organization. The self-assessment process is the upper-tier process for which all other processes for identifying vulnerabilities is an integral part. The chemical and radiological hazards associated with the operation or facility are well known to the line/facility manager and form the basis for the operating procedures and AB documents. Line and facility management are the logical point for the planning and implementation of effective self-assessment programs, since they manage the operation/facility expertise.

Nuclear Material Control & Accountability (NMCA) Audits

Comprehensive internal audits of each NMCA program element are conducted to provide assurance of the effectiveness of the implementation of the NMCA program. Audit frequency is established by DOE requirements, based on the category of nuclear material within the Material Balance Area.

Emergency Planning Exercises

The Y-12 Plant participates in the annual Oak Ridge Reservation Full Participation Exercise and performs self-assessments during sitewide drills. Each drill and exercise, noted in the Y-12 Plant

Emergency Plan, is subjected to an activity critique for vulnerabilities and areas for improvement. The results of exercises and drills are documented in exercise reports.

Price-Anderson Amendments Act (PAAA) Noncompliance Reporting Process

A strong historical site self-reporting philosophy and culture has been effectively integrated into the PAAA Noncompliance Reporting Process. The process is directed toward activities in and associated with Category 2 and 3 nuclear facilities as defined in DOE-STD-1027-92 (the Y-12 Plant has no Category 1 facilities) as well as radiological facilities. The Y-12 Plant PAAA Process is described in NS-120, *PAAA Noncompliance Determination Process*.

Critiques of Events

Reported unusual events are evaluated using a structured critique process led by a trained facilitator. The process is designed to gather facts concerning the event and determine the cause(s) including the identification of any vulnerabilities that may be present and contributed to the event.

4.2.2 Related Programs and Processes

The assessment, identification and tracking of vulnerabilities is managed using the dual processes of assessing ongoing programs and managing identified deficiencies. Formal assessment programs such as appraisals, audits, and surveillances monitor activities and provide an independent perspective in identifying vulnerabilities as issues for resolution. Each finding requires the development of corrective actions, which are tracked to completion in the Energy Systems Action Management System (ESAMS).

Issues Management Process

Issues management begins with the recognition and identification of an issue and ends with a permanent solution to the identified issue. "Issue" is a generic term for problems, deficiencies, findings, concerns, alerts, recommendations, observations, and other conditions requiring evaluation for corrective action. Elements of the Issues Management Process are identification of issues, grouping and prioritization of issues, planning of actions, performing and monitoring of actions, and verification of effectiveness.

To ensure issues were being effectively recognized and resolved, a Y-12 Issues Manager was appointed in 1996. The Issues Manager produces an Issues Management Report annually to describe major programmatic issues at the Y-12 Plant that have been identified over the past year.

ESAMS

ESAMS is a computer-based program that assists in the tracking of issues and associated corrective action plan(s). ESAMS allows the tracking of completion dates, issues automatic reminders, and provides tools to produce reports for management on delinquent action completions. Issues which are entered into the system are derived from audits, evaluations, as-found conditions, reviews, and deficiency reporting activities. ESAMS may also be used to track commitments from other processes, such as the Unreviewed Safety Question Determination Program and event critiques, where actions are required.

Occurrence Report Investigations

Occurrence notifications identified during facility operations come from incidents that occur during a planned activity, as-found activities that place the facility outside of the safety authorization basis, and conditions detected during normal site surveillance and maintenance activity. The closure of occurrence notification events requires the development of corrective actions, an evaluation for root cause, and reviews for lessons learned and generic implications. These assessments go well beyond the existing condition and look at the extent of the vulnerability across the facility, site, and Oak Ridge Reservation. (See Section 6.0 for further information).

Lessons Learned Review and Dissemination Process

The Lessons Learned Program is a process by which successes, problems, and uncommon experiences are recorded for the future and are communicated across the company and the DOE Complex. The information disseminated comes from experiences of employees, DOE and DOE contractors, and other government agencies and companies. This ensures a systematic and timely process of notifying various operating units if an experience is detected that could have significant adverse effects on quality, safety, the environment, or health. These reports often relate newly discovered vulnerabilities. (See Section 6.0 for further information).

5. TECHNICAL COMPETENCE

This chapter addresses the third initiative outlined in Secretary Peña's August 4, 1997, letter on the explosion at the Hanford Plutonium Reclamation Facility which requested:

> *DOE and contractor field organizations with operational responsibilities [to] assess the technical competence of their staffs to recognize the full range of hazards presented by the materials in their facilities, act on results, and implement training programs where needed.*

The Y-12 Plant has a DOE-approved Training Implementation Matrix (TIM) which defines and describes the application of the selection, qualification, and training requirements for their facilities. The matrix clearly defines the organizations, planning, and administration of the qualification programs and sets forth the responsibilities, authority, and methods for conducting training at these sites. Adequate justification for exceptions are included in the Matrix for any requirement not implemented and these are approved by the DOE Site Office.

Following initial employment, contractor personnel requiring unescorted access to DOE Oak Ridge facilities are required to attend GET. The GET programs include baseline Hazardous Materials training, baseline HAZCOM standards training, emergency response procedures, and employee reporting responsibilities training. This training is structured to meet the safety needs of each employee for access to the DOE Oak Ridge facilities. Examinations are administered following the completion of each segment of the GET program. Proficiency testing or refresher training and reexaminations are conducted every two years. Persons that have not completed GET or that failed the examinations are required to be under continuous escort.

Personnel who are identified to work with or around hazardous materials are required to be trained on the skills required by the specific job, training on the industrial, chemical, environmental or nuclear hazards associated with their job and surrounding facilities. The analytical laboratory personnel, for example, are trained to meet the 29 CFR 1910.1450 requirements for personnel who work with hazardous chemicals. In addition, the high hazard facility access requirements include training in radiation control, nuclear criticality safety, facility specific hazards, and facility emergency procedures training.

The contractor operating organizations are responsible for implementing training and qualification programs which ensure that employees, subcontractor personnel contracted to them, and visitors for whom they are responsible, receive adequate, cost-effective training commensurate with the hazard level and complexity of the operation associated with their respective job assignment. The operating organization's training staff, normally a training manager or coordinator and instructors/developers, ensure that employee training requirements are identified and documented as appropriate to their specific job. The employees' individual training program normally consists of: (1) entry level requirements; (2) initial job training requirements, as identified in the job/task

analysis or functional analysis; and (3) continuing training requirements to maintain qualification or proficiency.

The Y-12 facility training and qualification programs have been developed in accordance with the requirements and guidance of DOE Order 5480.20A and 10 CFR 830.120 Standards/Requirements Identification Documentation. These training programs have established processes for selection and assignment of personnel to operating organizations. This process considers factors such as background, experience, and education and is based on the ability of the person to meet job performance requirements. Selection of operating personnel may involve a selection examination. Entry-level requirements are specified in the qualification program for a specific job position/function. Personnel entering a qualification program for a specific job position/function shall meet the entry-level requirements for that position. Line management will determine entry level requirements based on the overall safety record for the specific facility, cumulative experience hours for total staff, and current operational condition of the facility.

Certification is a more rigorous training with testing and examination used by management to ensure that fissionable material handlers and their supervisors are adequately trained to perform their jobs safely and effectively. The qualification and certification of specific jobs in the TIM(s) are completed in accordance with the LMES and Y-12 training procedures.

Training records of personnel transferred from one organization or job to another are evaluated by the individual's new organization to ensure specific training requirements are met. Also, the individual records are reviewed to verify that plant-level training requirements are met. Additional training is provided for personnel who do not meet the requirements.

The following list of training courses are examples of those that are provided to the contractor staffs at DOE Oak Ridge facilities to satisfy the requirements of their specific job as identified through a job and task analysis:

- The HAZCOM training course is required for unescorted access to Energy Systems sites for more than ten days.

- HAZCOM Level 1 training is for all workers who work with hazardous chemicals.

- Hazardous Materials (DOT HM 126F) General Awareness, Familiarization and Safety training is for workers who transport small amounts of hazardous materials not in a commercial motor vehicle and/or load, store, or secure hazardous materials for transport.

- Carcinogen Control Program Training is required for workers in a carcinogen regulated area.

- The Hazardous Waste Operations and Emergency Response (HAZWOPER) 24-Hour training course is required for workers in waste operations at treatment, storage, and disposal facilities regulated by 40 CFR Parts 264 and 265.

- The HAZWOPER 16-Hour training course is required if a worker has completed the 24-hour HAZWOPER training and they are directly involved in RCRA corrective actions or cleanup operations and are required to wear Level C or greater personal protective equipment.

Many of the managers and technical staff personnel, as identified in the site TIM, are required to complete position-specific training. This training considers the following areas as they are applicable to the individual positions:

- Facility and organization
- Facility fundamentals; heat transfer, fluid flow, and thermodynamics; electrical science, nuclear physics, chemistry/chemistry controls, process controls
- Facility systems, components, and operations
- Simulator training, if applicable
- Environmental, Safety and Health Orders
- Codes and standards overview
- Facility document system
- Safety Analysis Reports and Technical Safety Requirements
- Nuclear criticality control
- ALARA and radwaste reduction program, and
- Quality assurance, quality control practices

The continuing training programs identify the training that is required to be conducted on a recurring schedule, which normally is on a two-year cycle, to maintain and/or enhance job knowledge and skills. The continuing training program is designed to support the training requirements of a specific job or position and is structured commensurate with the job responsibilities. For operating, maintenance, technical support personnel in qualified or certified positions who perform functions associated with safety-related structures, systems, and components identified in the facility basis documents, the continuing training includes training in:

- Significant facility system and component changes
- Applicable procedure changes
- Applicable industry operating experience
- Lessons learned
- Selected fundamentals with emphasis on seldom used tasks, knowledge or skills necessary to ensure safety
- System interactions and relationships with safety related processes
- Other training as needed to correct identified performance problems

Over the past several years, DOE has conducted a series of assessments on: (1) the technical competence of contractor staff at the DOE Oak Ridge facilities, and (2) site training and qualification programs. The contractor has also implemented a continuing training and qualification assessment program; which, in conjunction with the DOE assessments, collectively

provides a thorough review of the operating contractor staffs' job training programs and safe work practices. The Y-12 Plant conducted two training and qualification program management self-assessments in 1997. The results of these and other site assessments have been addressed, as required, by implementation of corrective action plans with the objective of identifying and assigning responsibilities for training program requirements. This structured approach to identifying training requirements based upon hazard level and complexity of operations associated with the employees respective job assignment and assigning responsibilities for implementing this training ensures that DOE Oak Ridge facilities operating contractor personnel receive adequate training so that they and the DOE Oak Ridge facilities can work safely and efficiently.

6. LESSONS LEARNED AND OCCURRENCE REPORTING

This chapter addresses the fourth initiative outlined in Secretary Peña's August 4, 1997, letter on the explosion at the Hanford Plutonium Reclamation Facility which requested:

> *DOE field offices must assess their site Lessons Learned and Occurrence Reporting programs to assure that 1) outgoing information is well characterized and properly summarized, and 2) incoming information is thoroughly evaluated, properly disseminated, appropriately implemented, and tracked through formal management systems.*

6.1 Lessons Learned Program

The LMES Lessons Learned Program provides a process for identifying, disseminating and utilizing positive and negative operating experiences which may be applicable to LMES staff. This program was implemented as a pilot in 1989 in the Engineering and Computing organizations and expanded to all areas of operation within LMES in 1991. The program was initially based on similar programs utilized within Martin Marietta aerospace operations. The program has since been expanded and further defined based on the guidance contained in the DOE Technical Standard, DOE-STD-7501-95, *Development of DOE Lessons Learned Program*, which was issued in 1995. There are numerous other DOE orders and guidance documents which reference lessons learned identification and utilization; however, no requirements are explicitly stated. The LMES Lessons Learned Program is defined in QA-331, *Lessons Learned Program*, and is integrated with other LMES programs, such as the Occurrence Reporting Program and Issues Management Program.

The overall objectives of the LMES Lessons Learned Program are to capture and share "good work practices" and innovative approaches to promote repeat application, and to capture and share adverse work practices or experiences to avoid recurrence. Any LMES employee can submit information as a potential lesson learned. Additionally, several different sources of information and operating experience are reviewed and evaluated for potential lessons learned. This information is reviewed by line organizations and/or the Lessons Learned program managers on a regular basis. These sources include those from within LMES, across the DOE complex, and other related technical sources. Some of the primary sources reviewed include:

- LMES occurrence reports
- Internal operating experiences
- Daily PSS logs of events
- Employee safety and health concerns
- Injury and illness reports
- Results of audits, assessments, investigations at LMES
- Results of performance improvement initiatives
- Readiness reviews

- Occurrences reported by other DOE facilities through the Occurrence Reporting and Processing System (ORPS)
- PAAA noncompliances (potential and actual)
- Lessons learned issued by other DOE facilities
- DOE Operating Experience Weekly Report
- DOE Safety and Health Bulletins
- DOE Safety Notices
- DOE Chemical Safety Newsletter
- DOE Accident Investigation reports
- Product recall notices
- Consumer Product Safety Commission advisories
- Underwriters Laboratories advisories
- DNFSB trip reports

The information collected from these inputs and reviews is compiled as a potential lesson learned. This information is validated by subject matter expert(s) to ensure consistency with policies and procedures, to identify the target audience for the lesson, and to define any recommended or required actions. This review also results in the designation of a priority level to be assigned to the lesson. Guidance provided in the DOE Lessons Learned Technical Standard is used to assist in this determination. For those lessons learned which are determined to have required actions, documented responses may be required and actions are formally tracked. Lessons designated as "Red Alerts" are issued by LMES senior management and require responses from all LMES organizations.

Dissemination of lessons learned information is accomplished via several methods. LMES utilizes its electronic mail system as the primary method to disseminate lessons learned to all organizations. Recommendations and requirements for actions associated with the lesson are included when the information is disseminated. This approach allows information to be disseminated in a short time period to a wide audience. A summary of all new lessons learned is generated and disseminated as a paper bulletin on a periodic basis in the LMES Operating Experience Summary Report. This report summarizes operating experiences from across the DOE complex that have potential applicability to LMES operations. The primary source of information for this review is ORPS. Both initial notification and final report information are included in this review. This report is widely disseminated across LMES.

Line organization managers are responsible for determining additional dissemination needs and utilization of the lessons learned information based on the applicability to their operations. Feedback indicates that this information is primarily forwarded via electronic mail, utilized in safety meetings, reviewed at staff meetings, placed in required reading, posted on bulletin boards, or summarized in internal memorandums. It is also incorporated into training and awareness programs and procedure revisions, as applicable.

Historical lessons learned information is also maintained on the LMES internal World Wide Web (WWW). Capabilities are provided to search and query historical lessons learned information. These capabilities currently allow users to search for information by the lesson priority, the functional category, or through a word search. Links are also provided to other sources of lessons learned and operating experience information. Access to the lessons learned information on the WWW is available to any LMES employee who has access to the LMES home page. This information has recently been electronically linked to the LMES work planning processes to allow the information to be evaluated as part of the work planning process. Enhancements are being made to expand the querying capabilities based on work activity and hazard area categories for each lesson.

Through October 1997, approximately 150 lessons learned have been documented and issued within LMES during 1997. LMES continues to evaluate all areas of operation for additional sources of lessons learned and to emphasize to all employees the importance of utilizing these experiences in their daily work and in their work/project planning. LMES has also been an active participant in DOE-wide initiatives associated with Lessons Learned Programs. These initiatives have provided a forum for benchmarking Lessons Learned Programs at other DOE facilities for incorporation into the LMES Lessons Learned Program.

6.2 Occurrence Reporting

The LMES Occurrence Reporting Program provides a process for identifying, reporting, and resolving reportable events or conditions. The LMES program is based on the requirements specified in DOE O 232.1 and DOE M 232.1-1, Occurrence Reporting and Processing of Operations Information and is defined in Energy Systems Procedure OP-301, Occurrence Notification and Reporting and Y-12 Plant Procedure Y10-192, *Occurrence Reporting.* These documents specify requirements and responsibilities of Y-12 staff for identification, categorization, notification, investigation, analysis, and reporting of occurrences. Additional requirements for off-site notifications are also included in this document.

The requirements stated in OP-301 and Y10-192, define specific responsibilities for all Y-12 employees to report immediately to line management or the Plant Shift Superintendent's (PSS) Office any actual or potential adverse event or condition. The inclusion of reporting potential adverse events or conditions ensures that determinations of reportability are made by Y-12 management and staff who are familiar with the criteria for categorizing occurrences. This also ensures that these situations are evaluated to determine if the potential for a near miss occurred or if they warrant reporting as a management concern.

The categorization of these events or conditions as reportable occurrences are made based on the information available at the time they are reported. The appropriate Facility Manager is responsible for the categorization of the event or condition, with the support of the PSS and the Y-12 Occurrence Reporting staff. Additional facility staff knowledgeable of the event or condition may be called on to support the Facility Manager in determining the categorization. If

there are uncertainties surrounding the level of categorization, the occurrence is categorized at the highest level that may apply. The categorization is made within two hours of the time of discovery of the event or condition. Recent changes in the interpretation of DOE requirements on the time of discovery are being incorporated into revisions to OP-301. Guidance has been provided to communicate these changes in the interim. These changes in interpretation have provided a challenge in meeting the requirements of categorization within two hours of time of discovery.

Procedures OP-301 and Y10-192 define the requirements for notification to LMES management, DOE and other off-site agencies and organizations on reportable occurrences. Verbal notification is accomplished, when required, via a "phone bridge" involving the DOE Headquarters Emergency Operations Center, the DOE-Oak Ridge Operations Emergency Operations Center, the responsible DOE Facility Representative and the responsible Y-12 Facility Manager. The Y-12 PSS serves as the coordinator for these notifications. Verbal notification requirements for external agencies and organizations such as the State Emergency Management Agency, the Environmental Protection Agency, the National Response Center, Local Governments, Local Emergency Planning Committees, Law Enforcement Agencies (i.e., Tennessee Highway Patrol, Federal Bureau of Investigation) and Lockheed Martin Corporation are also defined in OP-301 and associated guidance documents.

As part of the initial evaluation of the adverse event or condition, necessary steps are taken to secure the area and preserve any additional information as applicable. An initial review or critique is conducted as soon as possible after the event or condition is reported to compile pertinent information. This information is utilized to compile the Notification Report. The Notification Report is transmitted to ORPS by the end of the next business day (not to exceed 80 hours). Information is also captured within ESAMS to provide internal tracking of follow-up actions and responsibilities associated with resolution of the occurrence.

Follow-up or evaluation of events or conditions which are not determined to be reportable occurrences may be conducted. This determination is made by the Facility Manager.

Investigation of occurrences is the responsibility of the Facility Manager. They have several different resources available to assist them in conducting the investigation. The Facility Manager uses a graded approach in conducting the investigation. He/she may choose to conduct the investigation internally or may form a team of subject matter experts to aid in the investigation and analysis of the event. The analysis of the occurrence determines the direct, contributing, and root causes, the corrective actions, and any lessons learned associated with the event or condition. The root cause analysis may be accomplished by a variety of techniques depending on the complexity and/or safety significance of the event or condition. Several Energy Systems procedures exist to further define requirements in these areas, such as: QA-312, Issues Management Program; QA-331, Lessons Learned Program; QA-16.2, *Root Cause Analysis*. The results of this investigation and analysis are compiled in the Final Report, which is transmitted to

ORPS. The Final Report and associated corrective actions are also captured in ESAMS to support internal tracking and trending needs.

Dissemination of occurrence information across LMES is accomplished through several methods. On a daily basis, a summary of all new occurrences across the DOE complex is routed electronically across LMES. The LMES Operating Experience Summary Report includes information on all LMES occurrences and occurrences at other DOE facilities, which are potentially applicable to LMES operations. Information from both Notification and Final Reports are included in this report.

Formal training for LMES personnel concerning occurrence reporting consists of three specific courses: (1) "Introduction to Occurrence Reporting" covers the categorization criteria, the overall occurrence reporting process, and roles and responsibilities; (2) "Preparation of Occurrence Reports" covers the format of the DOE Occurrence Report and techniques for writing quality reports; and (3) "Investigation Techniques" covers best practices for investigating occurrences, interviewing skills, conducting critiques, and evidence gathering. Additional courses are also been offered within LMES on "Accident Investigation Techniques" (DOE-led course), root cause analysis techniques (i.e., TapRoot), and corrective action planning.

The DOE-ORO recently conducted a "For Cause Review" of the Occurrence Reporting Program at LMES Oak Ridge facilities. This review identified areas for improvement at LMES related to submittal of final occurrence report information. Initiatives have begun to address these concerns. Metrics have been established to monitor progress in this area. Progress on these initiatives will also be periodically reported to DOE-ORO. This review also cited a DOE-wide problem related to reporting of near-miss events. LMES staff will be participating in a forum on this topic at an upcoming DOE-wide Occurrence Reporting meeting. Additional guidance is also being developed for incorporation in revisions to OP-301.

Appendix A
Instructions on Facility Walkdowns

Appendix B
Y/NS-0001/R1
Preliminary Reassessment of Known Vulnerabilities at the Y-12 Plant

INTERNAL CORRESPONDENCE

LOCKHEED MARTIN ENERGY SYSTEMS

Date: September 30, 1997

To: J. A. Allard, W. D. Altman, J. H. Barker, D. E. Beck, G. L. Bowers, D. P. Bryant, L. C. Bryson, K. J. Carroll, W. L. Clements, J. L. Cook Jr., J. P. Crociata, N. A. Dobbs, J. G. Dorsey, R. E. Fenstermaker, J. P. Flynn, J. H. Gertsen, P. G. Greeson, R. E. Hawthorne, J. E. Heiskell Jr., S. H. Howell, C. J. Ihrig, N. C. Jessen Jr., O. W. Jones, D. Medovich, D. Milan, C. H. Moseley, W. A. Muenzer, C. R. Nook, M. J. O'Brien, T. W. Paul, M. M. Reichert, R. C. Riepe, R. K. Roosa, L. R. Ruth Jr., D. R. Smith, C. L. Stair, E. G. St. Clair, J. E. Stone, J. D. Stout, H. G. Travis, W. D. Turner, R. E. Upchurch, P. R. Wasilko, S. D. Weaver, A. K. Zava

c/atts: K. K. Baksa, C. A. Burditt, T. R. Butz, C. M. Eubanks, L. A. Felton, C. C. Hill, M. K. Morrow, D. W. Sheffey (RC), W. A. Sliski

c: F. P. Gustavson

From: F. P. Gustavson, 9704-2, MS-8010, 574-2527 **(Original Signed By)**

Subject: **Secretarial Initiative on the Explosion at the Hanford Facility**

As a result of the May 14, 1997, explosion at the Hanford Plutonium Reclamation Facility, Secretary Federico Peña issued a directive to all Department of Energy (DOE) facilities to conduct a broad-based initiative aimed at identifying and preventing similar situations. Included in the Secretary's initiatives is a request that DOE contractors scrutinize their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release. Particular emphasis should be placed on legacy chemicals and materials located in inactive facilities. Contractors are also required to promptly dispose of unneeded chemicals in accordance with appropriate safety requirements and environmental regulations.

Presently, there are multiple organizations and programs requiring accurate inventory information on chemical hazards associated with Y-12 facilities. Examples include the Safety Analysis and Emergency Preparedness programs and Environmental Protection Agency Superfund Amendments and Reauthorization Act of 1986 Title III reports. Actions taken by Lockheed Martin Energy Systems need to be responsive to the Secretary's initiative as well as take maximum advantage of these programs. A multidisciplined team assembled to respond to the above request has determined that augmenting and making maximum use of the Hazard Material Information System (HMIS) can best meet these objectives.

To facilitate this effort, Mr. Chuck Moseley, Nuclear Safety Manager, will be coordinating this activity at the business unit level. In addition, the following individuals have been assigned primary responsibility for coordinating the response for Y-12 activities:

Energy Systems Safety and Health	Bill Sliski and Kristen Baksa
Facility Safety	David Sheffey
Environmental Compliance	Clarence Hill
Issues Management	Cynthia Eubanks
Training	Lorry Ruth
Compliance	Carol Burditt
Nuclear Operations	Lee Bryson

Although this team will be developing the final report for Y-12, an important part of our self-assessments involves respective managers "walking their spaces" to determine if hazards are present that could contribute to an accident similar to the one at Hanford, coupled with the ongoing update of the HMIS and the completion of the attached self-assessment forms. This communication directs that the appropriate managers begin these walkdowns as soon as possible. If any relevant self-assessments, external assessments, or similar evaluations of chemical vulnerability have recently been performed or are under way, credit may be taken for these efforts in lieu of walkdowns. In that situation, reference the basis for your results in your response.

The requested forms must be forwarded to your Energy Systems Safety and Health contact no later than October 31, 1997. They will "roll up" the results to Energy Systems Health and Safety and can also assist you in evaluating any found conditions and making plans to dispose of any excess materials. A guidance document, instructions, and forms are attached to assist you in these efforts.

This is an important effort that must be completed along with our regular work assignments. I appreciate your continued support in these efforts.

If you have any questions regarding this initiative, please contact any member of the team or your identified Industrial Hygiene point of contact.

FPG:CHMoseley:be

Attachments (As Stated)

Attachment 1 to Memo,
Gustavson to Those Listed,
Dated: September 30, 1997

Y/AD-637

CHEMICAL STORAGE HAZARDS IDENTIFICATION

T. R. Butz

CONTENTS

INTRODUCTION

This document was developed to aid Y-12 Plant employees in identifying time-dependent chemical hazards in the workplace. Based on past plant activities, the identified hazards are the major hazards where time, isolation, and neglect can potentially increase the reactivity and danger of materials as they age. It is not intended that the information provided will prevent planned reactions, dictate emergency response actions, or prevent approved laboratory storage of small quantities normal to the Y-12 Plant operations. If the guidance provided herein is followed, adverse consequences normally associated with the use and storage of incompatible chemicals should be minimized.

The existing Y-12 Plant systems for using Material Safety Data Sheets (MSDS) and the Health and Safety professions on the contact list (see Appendix) should be used in case the situations discussed herein are discovered.

FORMATION OF PEROXIDES DURING STORAGE

Ethyl ether, isopropyl ether, tetrahydrofuran, and many other ethers tend to absorb and react with oxygen to form unstable peroxides which may detonate with extreme violence when they become concentrated by evaporation or distillation; when combined with other compounds that give a detonable mixture; or when disturbed by unusual heat, shock, or friction.

Peroxides may form in freshly distilled and unstabilized ethers within less than two weeks. It has been reported that peroxide formation begins in tetrahydrofuran after three days and in ethyl ether after eight days. Exposure to air, as in opened and partially emptied containers, accelerates formation of peroxides in ethers; and it is generally recommended that ethers which will form peroxides should be stored in full, air-tight, amber glass bottles, preferably in the dark.

Peroxide formation is not limited to ethers. Organic liquids, which tend to form peroxides in the presence of air, can be protected from oxidation by keeping them in contact with activated charcoal. This precaution minimizes the risk of explosion in stored liquids which contain alcohols, ethers, ketones, esters, and unsaturated compounds. No single method of handling seems suitable for inhibiting peroxide formation, although storage and handling under an inert atmosphere would be a useful precaution.

Each container of these materials should be **dated (1)** when received, **(2)** when opened, and **(3)** each time tested for peroxides. For isopropyl and diethyl ethers, it is recommended that even unopened containers be prepared for disposal after one year. Opened containers should be discarded after six months unless they have been tested periodically. Table 1 lists some materials which tend to form peroxides.

Precautions:

1. Containers of peroxidizable materials shall be clearly labeled as such.

2. Peroxidizable material containers shall have date received, date opened, and dates tested for peroxide formation.

3. DO NOT MOVE OR OPEN containers which do not have dates received, dates opened, and dates tested.

4. Containers opened more than six months without recorded testing should be isolated and disposal initiated.

5. DO NOT MOVE OR OPEN any container with visible evidence of crystalline solids or evidence of multiple layers within the container.

TABLE 1

Some Materials Which Tend to Form Peroxides During Storage

Acrolein
Aldehydes
Allyl ethyl ether
Allyl phenyl ether
Benzyl ether
Benzoyl-*n*-butyl ether
Bromophenetole
Butadine
p-Chloroanisole
Cumene
Cyclohexene
Cyclooctene
Decahydronaphthalene
Diacetylene
Dibutyl ether
Dicyclopentadiene
Diethylene glycol
Diethylene glycol diethyl ether
Diethyl ether
Dimethyl ether
Dimethyl isopropyl ether
p-Dioxane
Divinyl ether
Ethyl methyl ether
Methyl acetylene
o-Methylanisole
m-Methyphenetole
Phenetole
Potassium
Sodium-Potassium (NaK)
Sodium Amide
Tetrahydrofuran
Tetrahydronaphthalene
Vinyl acetate
Vinylidene chloride

HAZARDS OF PERCHLORIC ACID

Perchloric acid is a strong acid principally used to digest solids. Contact with the skin, eyes, or respiratory tract may produce severe burns. Perchloric acid is a colorless, fuming, oily liquid. When cold, its properties are those of a strong acid; but, when hot, it acts as a strong oxidizing agent. Hot perchloric acid reacts violently with organic materials. Aqueous perchloric acid can cause violent explosions if misused or when in concentrations greater than the normal commercial strength (72%). Perchloric acid solutions of 60-72% may form sensitive, powerful, explosive mixtures with organic materials. Anhydrous (dry or greater than 85%) perchloric acid is unstable even at room temperatures and ultimately decomposes spontaneously with a violent explosion. Contact with oxidizable material can cause immediate explosion.

The following are causes of fires and explosions involving perchloric acid:

1. The instability of aqueous or pure anhydrous perchloric acid under various conditions (Deposits in acid hoods, hood ducts, duct joints, fan systems, and exhaust stacks readily explode when the metal is disassembled or struck firmly. Ducts from perchloric acid hoods should be labeled at the hood face and each joint or floor level where personnel might contact or disassemble the duct.);

2. The dehydration of aqueous perchloric acid by contact with dehydrating agents such as concentrated sulfuric acid, phosphorous pentoxide, or acetic anhydride may convert the solution to the anhydrous acid which decomposes at ordinary temperatures and explode on contact with most organics; and

3. The reaction of perchloric acid with other substances to form unstable material. This can occur when perchloric acid hoods are used for other purposes.

The combustible materials, such as sawdust, wood, paper, burlap bags, cotton waste, rags, grease, oil, and most organic compounds, when contaminated with perchloric acid solution, are highly flammable and dangerous. Such materials may explode on heating, in contact with flame, by impact or friction, or may ignite spontaneously.

Precautions:

1. Containers of perchloric acid shall be properly sealed to prevent formation of dehydrated crystals or further concentration.

2. Perchloric acid containers shall be segregated from materials with which they can react including flammables, other acids, bases, organics, etc. Storage in the perchloric acid hood is desirable.

3. Containers shall be segregated from strong dehydrating agents.

4. Perchloric acid containers should show date acquired and monthly dates checked. Containers should be inspected regularly, and discolored acid should be discarded properly.

5. Perchloric acid hoods should be labeled such that only compatible substances or operations are allowed in the hood.

6. Perchloric acid hoods should not contain plastics, aluminum, copper, cloth, wooden or organic materials, or equipment manufactured with same.

7. Perchloric acid hoods, ducts, duct joints, fans, etc., shall be labeled such that employees at all possible access points are alerted to the danger.

8. Operating and maintenance procedures shall require that lab users be alerted before fans are made inoperable for any maintenance activity.

9. No vacuum pump, in a perchloric acid operation area, shall use petroleum lubricants.

AVOIDING STORAGE HAZARDS

The MSDSs made available to Y-12 Plant employees are the initial information source regarding hazardous chemicals. Proper labeling, inventorying, and storage of hazardous chemicals are required by plant procedures. Efforts to eliminate hazardous chemicals which have not been used for several years and have no foreseeable use should be continued.

The following summary data can aid the employee in identifying storage hazards and provide indications when to seek assistance. Table 2 provides a list of 23 chemical groups and indicates incompatibilities which exist between groups. This overview table may not be useful to all employees; therefore, Table 3 provides typical examples of these 23 groups as found in the Y-12 Plant inventory. Table 4 addresses specific reactive chemicals and storage considerations. Table 5 provides, in an even more general format, a list of words or word fragments that, when found in a chemical name, indicate reactive structure and potential hazard. Not every chemical compound name containing these words or word fragments is reactive, but most are.

Any stored chemicals with names included in Table 5 word fragments and/or whose hazards are unknown to the employee should prompt the employee to seek assistance from his/her supervisor or a person on the Contact List found in the Appendix.

Precautions:

1. Containers shall have legible labels. Labels shall be replaced before chemical hazard ratings are lost.

2. Replacement labels and secondary container labels should meet plant standards.

3. Container conditions shall be acceptable. Rusting metal, evidence of corrosion, brittle plastics, or cracked glass are unacceptable.

4. Water and air-sensitive materials such as alkali metals, hydrides, calcium carbide, etc., should be stored in low-humidity areas away from water sources. Container conditions should be monitored with age and well maintained. Once opened, these materials should be stored and handled under dried, inert gas.

5. Oxidizing chemicals such as chlorates, perchlorates, nitrates, peroxides, persulfates, and permanganates should be stored separate from organic chemicals, flammable or combustible liquids, acids, ammonium salts, sulfur, and other combustible materials.

6. Inorganic acids should be stored separate from inorganic bases.

7. Organic acids and anhyrides, such as acetic, should be stored separate from oxidizing acids, such as nitric and concentrated sulfuric.

8. Concentrated solutions of hydrogen peroxide should be stored separate from other oxidizing agents and combustibles. Polymer bottles will harden and crack over time. They should be set inside glass beakers.

9. Organic peroxides, azo compounds, pyrophoric metals, and flammable liquids are examples of chemicals which need separate and fire-protected storage.

TABLE 2

COMPATIBLE CHEMICAL GROUPS

Group Number	Chemical Group	Do Not Store with Group Numbers
1	Inorganic acids	2--8, 10, 11, 13, 14, 16--19, 21, 22, 23
2	Organic acids	1, 3, 4, 7, 14, 16, 17--19, 22
3	Caustics	1, 2, 6, 7, 8, 13--18, 20, 22, 23
4	Amines and alkanolamines	1, 2, 5, 7, 8, 13--18, 23
5	Halogenated compounds	1, 3, 4, 11, 14, 17
6	Alcohols, glycols, glycol ethers	1, 7, 14, 16, 20, 23
7	Aldehydes	1--4, 6, 8, 15--17, 19, 20, 23
8	Keytones	1, 3, 4, 7, 19, 20
9	Saturated hydrocarbons	20
10	Aromatic hydrocarbons	1, 20
11	Olefins	1, 5, 20
12	Petroleum oils	20
13	Esters	1, 3, 4, 19, 20
14	Monomers, polymerizable esters	1--6, 15, 16, 19--21, 23
15	Phenols	3, 4, 7, 14, 16, 19, 20
16	Alkylene oxides	1--4, 6, 7, 14, 15, 17--19, 23
17	Cyanohydrins	1--5, 7, 16, 19, 23
18	Nitriles	1--4, 16, 23
19	Ammonia	1--2, 7, 8, 13--17, 20, 23
20	Haolgens	3, 6--15, 19, 21, 22
21	Ethers	1, 14, 20
22	Elemental phosphorus	1--3, 20
23	Acid anhydrides	1, 3, 4, 6, 7, 14, 16--19

TABLE 3

COMPATIBLE CHEMICAL GROUP EXAMPLES

Group Number	Chemical Group	Typical Examples
1	Inorganic acids	Nitric, Phosphoric, Sulfuric
2	Organic acids	Acetic Acid, Formic Acid
3	Caustics	Metal Hydroxides
4	Amines and alkanolamines	Amine Curing Agents
5	Halogenated compounds	Freons, Methylene Chloride
6	Alcohols, glycols, glycol ethers	Isopropyl Alcohol, Propylene Glycol
7	Aldehydes	Formaldehyde
8	Ketones	Acetone, Methyl Ethyl Ketone
9	Saturated hydrocarbons	Hexane, Pentane, Octane
10	Aromatic hydrocarbons	Toluene, Aniline, Nitrobenzene
11	Olefins	Butene, Dichloroethene
12	Petroleum oils	Mineral Oil, Kerosene
13	Esters	Ethyl Acetate
14	Monomers, polymerizable esters	Vinyl Acetate, Styrene
15	Phenols	Pentachlorophenol, Bisphenol A
16	Alkylene oxides	Epoxies, Ethylene Oxide
17	Cyanohydrins	Acetone Cyanohydrins, Hyrogen Cyanide
18	Nitriles	Acrylonitrile, Cyanamide
19	Ammonia	
20	Halogens	Chlorine, Bromine
21	Ethers	Tetrahydrofuran, Diethyl Ether
22	Elemental phosphorus	
23	Acid anhydrides	Acetic Anhydride, Maleic Anhydride

TABLE 4

INCOMPATIBLE CHEMICALS

The substances in the left-hand column must be stored and handled in order that they cannot come into any contact with the substances in a corresponding position in the right-hand column.

Alkaline and alkaline-earth metals, such as sodium, potassium, cesium, lithium, magnesium, calcium	Carbon dioxide and chlorinated hydrocarbons. (Also prohibit water, foam, and dry chemical on fires involving these metals.)
Acetic Acid	Chromic acid, nitric acid, perchloric acid, peroxides, and permanganates.
Acetone	Concentrated nitric and sulfuric acid mixtures.
Acetylene Gas	Chlorine, bromine, copper, silver, fluorine, and mercury.
Ammonia Gas	Mercury, chlorine, calcium hypochlorite, iodine bromine, and hydrogen fluoride.
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, and finely divided organics or combustibles.
Aniline	Nitric acid, hydrogen peroxide.
Bromine	Ammonia, acetylene, butadiene, butane and other petroleum gases, sodium carbide, turpentine, benzene, and finely divided metals.
Calcium Carbide	Water produces flammable acetylene gas (see acetylene).
Carbon, Activated	Calcium Hypochlorite.
Copper	Acetylene, hydrogen peroxide.

TABLE 4

INCOMPATIBLE CHEMICALS
(Continued)

Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organics or combustibles, and oils and greases.
Chromic Acid	Acetic acid, naphthalene, camphor, glycerol, turpentine, alcohol, and other flammable liquids.
Chlorine	Ammonia, acetylene, butadiene, butane and other petroleum gases, hydrogen, sodium carbide, turpentine, benzene, and finely divided metals.
Chlorine Dioxide	Ammonia, methane, phosphine, and hydrogen sulfide.
Fluorine	Isolate from everything.
Hydrocyanic Acid	Nitric acid and alkalis.
Hydrogen Peroxide	Copper chromium, iron, most metals or their salts, any flammable liquid, combustible aniline, nitromethane.
Hydrofluoric Acid, Anhydrous (Hydrogen Fluoride)	Aqueous or anhydrous ammonia.
Hydrogen Sulfide	Fuming nitric acid and oxidizing gases.
Hydrocarbons (Benzene, Butane,) Propane, Gasoline, Turpentine, Etc.)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide.
Iodine	Acetylene, anhydrous or aqueous ammonia.
Lithium Hydride	Strong oxidizers, air, and moisture.

TABLE 4

INCOMPATIBLE CHEMICALS
(Continued)

Mercury	Acetylene, fulminic acid, and ammonia.
Nitric Acid (Conc)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, metallic powders, and nitritable substances.
Nitroparaffins	Inorganic bases.
Oxygen	Oils, grease, hydrogen, flammable liquids, solids or gases, and ethers.
Oxalic Acid	Silver, mercury.
Perchloric Acid	Acetic anhydride, ethanol, methanol, bismuth and its alloys, alcohol, paper, wood, grease, oils.
Peroxides, Organic	Organic or mineral acids; avoid friction.
Phosphorus (White)	Air, oxygen.
Potassium Chlorate	Acids (see also chlorate) and organic matter.
Potassium Perchlorates	Acids (see also perchloric acid).
Potassium Permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid.
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid, ammonium compounds.
Sodium	Air, halide compounds, acids, sulfur, water.
Sodium Oxide	Water.

TABLE 4

INCOMPATIBLE CHEMICALS
(Continued)

Sodium Peroxide	Any oxidizable substance, such as ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerol, ethylene glycol, ethyl acetate, methyl acetate, and furfural.
Sulfuric Acid	Chlorates, perchlorates, permanganates.
Thiocyanates	Chlorates, nitrates, nitric acid, oxidizing agents, and peroxides.
Zirconium	Prohibit water, foam, and dry chemical on zirconium fires.

TABLE 5

WORDS AND WORD FRAGMENTS THAT SIGNAL POTENTIAL HAZARDS

acid	brom	hydroxide	nitroso
acryl	caustic	isocyanate	peroxy
alcohol	chlor	ketone	phenol
aldehyde	chrom	mercaptan	sulfide
allyl	cyan	nitrate	thio
amine	epoxy	nitrile	vinyl
anhydride	glycol	nitro	

REACTIVE METALS STORAGE

Reactive metals such as lithium, potassium, and sodium react vigorously with moisture to form metal hydroxide and flammable hydrogen gas. Lithium and sodium should be stored under dried mineral oil or other hydrocarbon liquids free of oxygen and moisture. It is specifically recommended that potassium be stored under dry xylene. The Y-12 Plant sometimes stores these metals under dry argon or in glove boxes having dry, inert purges.

Reactive metals have similar reactions and form explosive mixtures with several halogenated hydrocarbons, some metal halides, mercury, oxidizing materials, and strong acids. Additionally, potassium, sodium-potassium alloy (NaK), and sodium amide will form peroxides even when stored under mineral oil. Water-sensitive peroxidizables, once opened, should be handled and stored in an inert atmosphere or under dry xylene.

Precautions:

1. Container seals and blanket materials shall be suitable to avoid moisture infusion.

2. Containers shall be properly secured to prevent toppling due to accidents.

3. Sprinkler system activation, broken water lines, or flooding should not create a potential for exposure of the metals to water.

4. The container shall have proper labels and be free of extensive corrosion.

5. Gloves boxes under inert purge shall have the proper labels and controls to prevent unauthorized valving off of the purge gas.

6. The design of purged containers shall protect reactive metals in the event of loss of purge gas.

7. The purge gas source should have a gas line drier if moisture contamination is possible.

UNSAFE STORAGE OF URANIUM

Unsafe storage of uranium can occur as the result of pieces of metal that are not identified as uranium. Uranium metal corrodes in air, forming finely divided uranium oxides that are an inhalation and ingestion hazard. The corrosion layer can be gun-metal blue or tan, depending on its thickness and extent of oxidation. This loose layer can allow unchecked spread of contamination.

Finely divided uranium (saw fines, machine turnings, sludges) is flammable. Uranium reacts slowly with water to form hydrogen gas. Three types of safety hazards should be considered: container pressurization that might lead to a violent rupture, hydrogen gas fires, and detonation of a hydrogen-air mixture.

Precautions:

1. Ask Radiological Control to survey unlabeled material that may be uranium.

2. Accumulated corrosion product around any metal piece may indicate uranium.

3. Labels on uranium containers shall not be allowed to degrade to the point they become unreadable or dislodged.

4. Finely divided uranium should not be stored under circumstances that might allow it to dry out and have access to air.

5. Uranium storage drums or containers that are swollen shall be reported immediately.

6. Containers known to contain wet uranium (turnings, saw fines, etc.) shall be vented.

7. Uranium shall not be stored in dead sir space such as stairwells, closets, or unventilated sheds.

8. Any accumulation of corrosion product on uranium metal shall be contained to prevent its becoming airborne.

APPENDIX

CONTACTS LIST

ENERGY SYSTEMS SAFETY AND HEALTH STAFF ASSIGNMENTS

ORGANIZATION/CONTACT	PHONE NUMBER	PAGER NUMBER
Defense Programs Safety and Health Field Operations Department Head		
R. T. Ford	576-7182	873-9318
Nuclear Operations Support Group Leader		
M. A. McKinney	574-1568	873-7542
Non-Nuclear Operations Support Group Leader		
L. C. Brantley	241-2488	873-5902
Facilities Management Organization Support Group Leader		
D. W. Neubauer	574-1562	873-9312
Engineering and Contractor Support Group Leader		
E. W. Werden	576-6048	873-9439
Technician Support Group Leader		
R. P. Ferguson	576-4612/574-7987	873-9143
Facility Safety		
D. W. Sheffey	576-8499	873-6984
J. S. Anderson	576-5608	873-9636

FIELD OPERATIONS SUPPORT STAFF ASSIGNMENTS

ORGANIZATION	SAFETY AND HEALTH SUPPORT CONTACT	PHONE NUMBER	PAGER NUMBER
Analytical Services	L. E. Cooke	574-9155	873-9247
	R. W. James	574-5960	873-9535
Business Management	B. K. Brown	241-2493	873-9249
	S. S. Wilson	574-1566	873-9453
Criticality Safety	G. L. Bean	576-8195	417-5247
	A. Felder	576-5447	873-5423
Decontamination and	W. O. Lawless	574-3526	873-7983
Decommissioning/Bldg 9201-4/5	R. W. James	574-5960	873-9535
Defense Programs	G. L. Bean	576-8195	417-5247

Depleted Uranium Operations	E. E. Yowell	241-2490	873-5909
	P. A. Porter	574-1563	873-9467
Development	R. W. James	574-5960	873-9535
	S. M. Hollenbeck	574-9547	873-9248
Disassembly and Storage	L. E. Cooke	574-9155	873-9247
	J. S. Greene	574-1560	873-9289
DSO Warehouses	K. G. Steele	574-5655	873-9130
Engineering/Construction/	E. W. Werden	576-6048	873-9439
Subcontractors/Off-Site Leased	H. E. Carter	574-7908	417-5839
Facilities	G. N. Fowler	576-7189	873-5902
	J. E. Griffin	241-2494	873-5912
	R. L. Montgomery	576-3718	873-9445
	H. S. Pichiarella	574-1564	873-9438
Enriched Uranium Operations	P. D. Calkin	576-7183	873-5905
	J. S. Greene	574-1560	873-9289
	M. H. Burnett	574-5639	873-9259
	W. T. Cowan	574-1672	873-9430
Building 9206 Operations	K. G. Steele	574-5655	873-9130
Environmental Management	G. L. Bean	576-8195	417-5247
	S. S. Wilson	574-1566	873-9453
Facilities Management	D. W. Neubauer	574-1562	873-9312
	T. T. Foster	576-4721	873-5828
	J. B. Peters	574-2178	873-9134
	V. W. Phillips	576-0303	873-5810
	D. A. Ray	576-6233	873-7623
	J. A. Phillips	574-3286	873-9452
	L. L. Foust	576-6232	873-7603
General Manufacturing	B. K. Brown	241-2493	873-9249
	R. W. James	574-5960	873-9535
Health and Safety	G. L. Bean	576-8195	417-5247
	S. S. Wilson	574-1566	873-9453
Human Resources	S. M. Hollenbeck	574-9547	873-9248
	S. S. Wilson	574-1566	873-9453
Information Management	M. M. Rich	576-6461	873-9241

Services/Information Technology Services	A. Felder	576-5447	873-5423

Product Certification	R. B. Harris	576-6238	873-9000
	R. W. James	574-5960	873-9535
Property and Materials Management	A. Felder	576-5447	873-5423
	W. E. Porter	576-6698	873-9321
Protective Services	B. K. Brown	241-2493	873-9249
Quality Services	R. B. Harris	576-6238	873-9000
	R. W. James	574-5960	873-9535
Radiological Control	G. L. Bean	576-8195	417-5247
	A. Felder	576-5447	873-5423
Respirator Fit-Test Facility	M. M. Rich	576-6461	873-9241
	L. B. Foxworth	576-6461	873-9246
	L. A. Hyatt	574-3549	
Site Management Services/Site Operations and Emergency Preparedness	G. L. Bean	576-8195	417-5247
	S. S. Wilson	574-1566	873-9453
	A. Felder	576-5447	873-5423
Special Materials Operations	P. A. Porter	574-1563	873-9467
	W. E. Porter	576-6698	873-9321
Technology Services	A. Felder	576-5447	873-5423
	M. M. Rich	576-6461	873-9241
Waste Management	C. A. Groover	576-3976	873-9245
	R. W. James	574-5960	873-9535

September 1, 1997

Attachment 2 to Memo,
Gustavson to Those Listed,
Dated: September 30, 1997

INSTRUCTIONS

The following instructions are provided to all facility managers who use or store hazardous chemicals. The instructions are also provided to Central Engineering Services to identify chemicals used by contractors performing construction work for Lockheed Martin Energy Systems:

1. Update the Hazard Material Information System (HMIS) by confirming and/or changing existing database inventories. Include hazardous chemicals in use in process systems as well as in storage. Also, identify those chemicals which are considered candidates for excess. If your are unsure how to handle this task, contact your respective hazardous material or Energy Systems Safety and Health representative for assistance. Complete the Excess and Residual Chemical Summary form.

2. Identify locations containing hazardous chemicals in facilities that have been shut down, are in standby, are being deactivated, or have otherwise changed their conventional mode of operation.

3. Identify hazardous residual chemicals in process piping, tanks, ventilation ducts, etc. This effort should focus on inactive facilities and systems. Complete the Excess and Residual Chemical Summary form.

4. If any chemicals are of a classified nature, revise facility classified chemical lists appropriately. Include chemicals in storage, use, or as residuals. Designate any considered as candidates for excess.

5. Perform a chemical compatibility determination using the enclosed guidance document, Y/AD-637, *Chemical Storage Hazards Identification*, on chemical and waste storage. Also, consider any incompatibilities of chemicals with their container/environment. Complete the Material Incompatibility Summary form.

6. Identify gas cylinders containing hazardous inventories. Complete the Gas Cylinder Inventory form. (NOTE: This form is for government and non-AVID cylinders only.)

7. Forward the completed forms to your Energy Systems Safety and Health representative by October 31, 1997. Forward any classified lists to Ron Evans, Building 9115, MS-8223.

Attachment 3 to Memo,
Gustavson to Those Listed,
Dated: September 30, 1997

Memo Title:

Secretarial Initiative on the Explosion at the Hanford Facility

Assessment Forms:

1. Material Incompatibility Summary
2. Excess and Residual Chemical Summary
3. Gas Cylinder Inventory

Material Incompatibility Summary

Organization: **Manager:**
Date: **Phone Number:**

Building Number	Location Within Building	Storage Area Identification Number (if applicable)	Describe Material Incompatibility (if none, so indicate)	Describe Corrective Actions, Including Completion Date (if appropriate)

NOTE: The Material Incompatibility Assessment should address storage of incompatible materials in adjacent spaces, mixing of incompatible chemicals, and compatibility of the storage container. (Use guidance document Y/AD-637, *Chemical Storage Hazards Identification*, to assess incompatibility.)

Excess and Residual Chemical Summary

Organization: **Manager:**
Date: **Phone Number:**

Building Number	Location Within Building	Storage Area Identification Number (if applicable)	EXCESS	RESIDUAL	Chemical Material	Quantity (if known)	Comments, including description of disposal or safe storage plan for excess chemicals and location of residual chemicals (e.g., tank number, process piping, etc.)

NOTE: Excess chemicals include, but are not limited to, laboratory, process (including research and development), maintenance, and construction chemicals and materials that currently have no identified use. Residuals may be contained in abandoned equipment (e.g., tanks, process piping, and ventilation systems).

Gas Cylinder Inventory
(NOTE: For Government and Non-AVID Cylinders Only)

Organization: **Manager:**
Date: **Phone Number:**

1. Cylinder Bar Code ID or Serial No.	2. Cylinder Contents (i.e., description) or Color Code (if label missing)	3. Location (i.e., building, pad, staging area, storage area, etc.)	4. Is cylinder in service or available for service? (Yes or No)	5. Is there an identified use for this material within 90 days? (Yes or No)	6. If No. 5 is "No," can cylinder be returned to vendor? (Yes or No)	7. Is cylinder designed to accept a cap? (Yes or No)	8. Is cylinder cap in place? (Yes or No)	9. Additional information/ comments/concerns, including last hydropressure date and inspection